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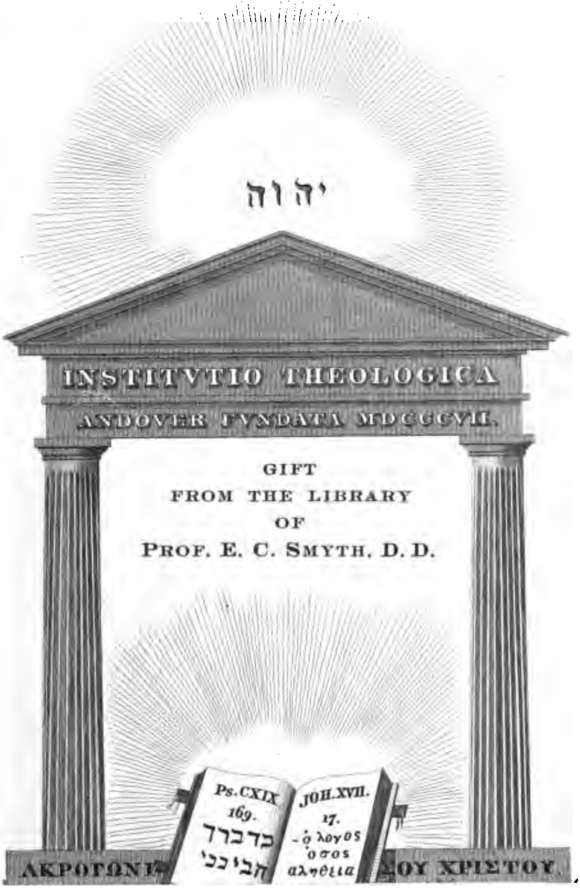

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PHYSICO-PHYSIOLOGICAL RESEARCHES

ON

THE DYNAMICS

OF

MAGNETISM, ELECTRICITY, HEAT, LIGHT, CRYSTALLIZATION, AND CHEMISM,

IN THEIR RELATIONS TO

Vital Force.

BY

BARON CHARLES VON REICHENBACH.

THE COMPLETE WORK,
FROM THE GERMAN SECOND EDITION.

With the Addition of a Preface and Critical Notes,

BY

JOHN ASHBURNER, M. D.

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> "Einer neuen Wahrheit ist nichts schädlicher, als ein alter Irrthum."
>
> "Nothing is more injurious to a new truth than an old error."
>
> *Göthe.*

> "In science, nothing may be built upon uncertain possibilities; science may not be a tissue of conjectures: it must consist, as far as possible, of a system of demonstrated realities."
>
> *Berzelius.*

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PREFACE.

THE present edition of a translation of these Researches owes its existence perhaps to one, perhaps to a series of misapprehensions, with which the public may have little concern. Certain it is, that at no time, have I had the slighest intention to be guilty of a want of courtesy towards the gentleman who had, by the publication of a very skilful abstract of his labors in the year 1846, the merit of introducing the Baron von Reichenbach to the British public, as an investigator of the Philosophy of Mesmerism. Various efforts have been made to convince me that I did not act as I ought to have done, in omitting to place myself in communication with Professor Gregory, when I was applied to by the Publisher, through a well-known literary physician, to furnish some notes to a complete edition of these Researches; but I confess my obtuseness shuts out from my mind the light of all the reasoning that has been brought to bear on this matter. All that I can allow is, that although I have no personal acquaintance with the Professor, I am very sorry in any way to have injured his feelings, and I am grieved to find myself in such a relative position with a man for whom I am bound to entertain a deep respect; for, besides his high scientific reputation, he is known to have the courage to avow his belief in Phrenology and in Mesmerism, "even in the spirit of truth, whom the world cannot receive, because it seeth him not, neither knoweth him; but," to all like the Professor, it may be said, "ye know him, for he dwelleth with you, and shall be in you!" To me, feeling quite innocent of all wrong intention, in the perfect freedom of action which, under the circumstances, I claim for myself, it is sad to be at opposite poles with one who is of the salt of this earth. To those who cannot know of the dire consequences resulting from the aggregation of the petty and repulsive mental forces concentrating and directing in society the baneful powers of their various influences upon characters who dare to think for themselves,—who are hardly aware that new truths are met so frequently by sneers, taunts, ridicule, or that unworthy social persecution, at once the proof of a want of capacity to be noble and just, and the disgrace of an advanced civilization,—the exalted courage of such persons must be lost. To those who know how to respect scientific ardor, and a pure love of truth, the fortitude of a faithful and sincere man is for high admiration, and for deep respect.

Such observations are perhaps equally applicable to the Professor, and to his friend the Baron, and I may be regarded as bold in remarking, as freely as I have done, on some of the philosophy in the following pages. No one can entertain a deeper veneration for large cerebral organizations than I do. I am clear, from the work before us, that so much patience, so much ingenuity, so much caution, so much concentration, so much ideal resource, so much just and honest desire to be true, could not characterize any individual, who had not a rare combination of organs in his magnificent head. Regarding any person in this point of view, one is immediately at liberty to look out for all those inconsistencies that belong to humanity; deeply respecting the excellencies, and always, with due humility, doubting one's own power of detecting the weakness that may belong to any logical edifice he may construct.

There are not wanting persons who doubt entirely of the Baron's power of accurate and severe observation. They doubt some of his most striking facts. They deny the accuracy of his results with the magnet and photographic plate. Some, and among them are persons of no mean note as scientific characters, affect to hold him in very secondary estimation—pitying him for wild ideas, and denying that his researches deserve any rank as philosophy.

But the Baron is not the builder up of a tall house of loose cards to be toppled down by a breath. I have not tried all his experiments. I have tried, *comparatively*, only a few. Where I have found the suitable cases, the results have been, with few exceptions, identical.

Then, because I have been disappointed in the results of many other experiments, I have no right to conclude that the Baron is at fault, but rather that I have not yet been fortunate enough to meet with exactly the same description of case he terms the "*sick sensitive*,"—a vague expression of an idea, with which, surely, it is not criminal to disagree. Long before I had read Professor Gregory's abstract, I had arrived at conclusions on differences, as well as analogies, between electric, magnetic, and mesmeric agencies, and, operating differently, have witnessed many confirmations of the facts established by the Baron. Dr. Elliotson has noted many remarkable analogies in many pages of the *Zoist*. But then, the greater number of our cases have been in mesmerized persons. How the Baron would have fared, as to his conclusions, if he had not taken up the study of his subject, in its most elemental form, is another question. Seeing, as I do, the conditions of his patients, in a different point of view, from that in which he regards them, I cannot concede to him that, professing to contemn the mesmeric state, as one unfit for his purpose, he has not been operating with persons, who, though not at all asleep, have actually been in a state constituting the very condition which distinguishes some of the phenomena of somnambulism. One mistake has been, to suppose that the truthfulness of an individual depends upon a certain normal state of the general fibres of the brain, instead of the tendencies derived from a particular relative size, and combination of certain organs of that viscus. A patient, who is a sleep-waker, may, from a certain configuration of organs, be a most just and honorable character, and have that fine disposition considerably exalted by the state of somnambulism; while a wide-awake person may be a most cunning and habitual deceiver. Another mistake is, to suppose that the "sensitive," and "sick sensitive," form a category, independent of all phrenological, and all mesmeric considerations. They are, in fact, those most easily affected by mesmeric and crystallic agencies—those most obedient to the influence of the silent will—and those most easily stimulated to clairvoyance, in the state of wide vigilance. Certain I am, that with the advantages offered by the power of his head, the Baron would have advanced both further and faster, if, to all his other knowledge, he had combined a more extensive view of physiological pathology, with a study of phrenology and mesmerism. They may oppose the truth in Germany, as they do here. The Author exhibits some of their doings, but the Baron has the courage flowing from a sense of justice. He worships the spirit of truth, which must eventually prevail. I marvel at many of the objectors to his philosophy, for in regarding these researches with the eye of criticism, ready to seize a weak point, I feel that one is at a loss which most to admire,—the plain, straightforward, philosophical acumen which guides each consecutive inquiry, or the combination of ingenuity and common sense with which questions of great delicacy are made subservient to the progress of severe inquiry. Time and opportunity only are required to corroborate rather than to correct the facts he has advanced. Those who venture to risk their own reputations in throwing doubts on the Baron's results, should remember that the *conditions under which the experiments were originally made, must, in justice, be strictly repeated.* The discoverer of creosote, paraffine, eupion, and many other new compounds, for the knowledge of which the world is indebted to his laborious researches, is not a common-place authority; and he has now taken up a subject, the truth of which will roll with tremendous force over all obstacles.

Those who regard the science of Physics, in the isolated form in which it is generally presented in most of the Elements of Natural Philosophy, must necessarily have a very limited view of the importance of the researches now presented to the public. Indeed, it would be, at present, almost impossible to indicate all the points in cosmogony, to which the Baron von Reichenbach's commencement, in strict logical deduction, on imponderable agencies, may not, at a future period, have a positive reference. It may be remarked, that the evolution of each new fact is a step in that progress, which may be ultimately connected with the forces, agencies, fluids, or powers that pervade space in universal nature.

Undoubtedly, the attempt to place Mesmerism within the domain of physics was a bold conception. It is an attempt to bring the whole of physiology into the strict limits of chemical philosophy. The establishment of the existence of the odic force is that which was wanting to reply to most of the questions respecting life. No doubt much is yet to be desired in order to clear the obscurities enveloping the innumerable modifications of this force; but enlightenment reaches us from the enlightened, and the Baron pursues his continued researches with a zeal which promises to unfold to us many a new principle, as well as many a new fact connected with this subject; and, considering the very curious investigations which will be published in the second part of this work, it is hardly too much to anticipate that we may, ere long, be favored with some insight into the philosophy of a subject evidently connected with the matter of light, or in some way allied with that of the development of either latent light, or of some combination of a share of this principle with certain organic re-agents. The researches into odic light by the Baron do not appear yet to belong immediately to clairvoyance, and yet the links which connect the inquiries are not far off. Numerous questions suggest themselves in an examination of the philosophy of this subject:—Why the condition of brain favorable to the development of clairvoyance should belong to certain individuals, and not to others? Why it should belong to some nervous susceptible temperaments, and not to others? Why some insane persons should be in the category, and not others? Why in some brains these peculiar developments of mental lucidity should take place, quickly and easily, by peculiar stimulants, while others should require a long period for the attainment of the object? Why, in some, the phenomena are not produced without a long course of mesmeric sleep, while in others, the presence of certain individuals, or of certain crystals, or of clear bottles of clean mesmerized water, in the same room, suffice to excite the brain to the requisite condition? In one and the same person, one mesmerizer shall never be able to produce clairvoyance; another mesmerizer will establish it, at the first séance. I have no doubt of these facts: I have often witnessed them. I have produced the condition of clairvoyance; but the kind and the degree of the phenomena differed, very remarkably, from those produced by Major Buckley, in the same patients. Repeatedly I have tried, in vain, to make clairvoyant somnambules read printed words which were enclosed in a pill-box. Major Buckley, ignorant of the same words, has had them quickly read in the innermost of a nest of five, four of them tightly-fitting silver boxes. The stimulus afforded by the odic lights issuing from my brain, must then be very different from that of those emitted by his. I have elsewhere said, (*Zoist*, vol. iv., p. 125) before the abstract of the work of Reichenbach appeared here, that "striking facts may be adduced which may tend to the conclusion that the *exercise* of the faculties of the human mind, and particularly that of the will, is attended by the emanation of a fluid from the brain, from the fingers, seats of the functional extremities of the nerves, or from some part of the person who may be exercising the mental faculties. I propose to show that the same series of events may be produced in individuals *of a certain nervous diathesis*, by the impingement of a fluid evolved by the will of another; or by manipulations attended by the emanation of the same fluid, or by certain emanations from magnets, or from some metallic wires, through which currents of electricity are passed; or from the direct application of certain metals. I do not attempt to establish the *identity* of these fluids, for the facts daily developing themselves tend to show that the distinctive properties of these fluids are as *various as the substances from which they emanate;* and it may be that the great power, antecedent to all consequents, may ordain the simplicity and unity of one electric, and gravitating with centrifugal force, evolving an infinite complication and variety of magnetic cohesive and repulsive agencies; the entire system emerging from the volonté directing 'La Grande Formule.'"* All these considerations are for inquiry. They must meet with scrutiny, and new truths will be elicited, multiplying the facts, prolonging the interest and the fame attached to the genius of the discoverer of the odic force. We are but at the commencement of the wonders of clairvoyance, and can certainly be in no position to estimate the great fund of new truths, that by means of its cultivated agency, are in store for us. We are so often met with objections as to the possibility of the phenomena of clairvoyance, that after the Baron von Reichenbach's arguments on the varying powers of various individuals to perceive the odic flames, one is tempted to adduce the fact discovered by Sir Isaac Newton, that the densest and heaviest metal, gold, has more pores† in it than solid metallic particles, and consequently that light may be transmitted through it; and if so, it is quite possible to conceive of its being diaphanous to certain individuals possessed of a highly sensitive nervous system. But what are the marvellous things of clairvoyance, compared to those contained in a supplementary note to the relation between Holy Scripture and some parts of geological science, by Dr. Pye Smith, to which I refer below in order to cause reflection on such matters?* Here our object is

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* A series of essays, under the signature of Ignotus, appeared in the London Journal and Repertory of Arts, Sciences, and Manufactures, in the year 1848, which contained many very ingenious speculations on imponderable bodies, and which, though not founded on original experimental inquiry, are deserving of attention from the point of view in which these agencies are regarded,

Ignotus maintains that three distinct kinds of imponderable matter exist in nature, namely—magnetine, or the principle of magnetism; lumine, or the principle of light; and calorine, or the principle of heat; and that the whole of these are capable of existing in either a free or latent state, and of manifesting *chemical* agencies, by virtue of which they are mainly influential in inducing the various phenomena which nature exhibits,—as, for instance, the tendencies of the chemical elements (of which they are constituents), to enter into chemical action and produce new compounds. Upon their agencies depend the principle of gravitation, of the aggregation and segregation of the molecules of ponderable matter; of ordinary electricity; of voltaism and catalysis; and it is upon their operation, but more particularly on the influence of magnetine, that the vital functions, in all their modifications, are dependent.

With respect to electricity, Ignotus regards this principle as distinct from magnetism and voltaism, and attributes its phenomena to the disengagement of a hitherto undescribed ponderable chemical element, which he terms *electrine*, and which he assumes to be an essential constituent of oxygen.

I have reason to believe that, since his original publication, Ignotus has occupied himself with important alterations and additions, his views now extending to the creation of the universe, and constituting in fact a new chemical theory of nature.

† See "A Dissertation on the Æther of Sir Isaac Newton," by Bryan Robinson, M.D., p. 11.

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* In the 'Philosophical Transactions' for 1800, is a paper by the late Sir William Herschel upon the *Power of Telescopes to Penetrate into Space*, a property distinct from the *magnifying* power. By observations and calculations, which appear to have been corroborated by facts independently and previously ascertained, the space-penetrating power of his forty feet reflector is brought out to be a little more than 191 times that of ordinary natural vision, or extending to more than 300,000 times the distance of Sirius, which, on satisfactory grounds, is regarded as one of the nearest of the fixed stars. The light by which Sirius is seen by us, moving at its known velocity of 192,000 miles in a second, is at least six years and four months on its passage from our system. By applying the equation which Sir William had established, he brought out that the brilliant nebulæ, which only that telescope can reach, are distant from our earth such an immense number of miles, that to express them our arithmetical numeration requires twenty figures, of which the first eight are 11,765,475, the eleven denoting trillions, and the other number billions; the remaining part of the sum being much more than 948,000 millions. This almost unmanageable number is expressed by Sir William Herschel thus—'above 11¾ millions of millions of millions of miles!' It follows that the light by which those bright objects become visible to us cannot have been less than one million and nine hundred thousand years in its progress.

Yet when we have strained our minds to contemplate, in the extremely feeble manner to which our faculties are competent, this overwhelming distance, we have no reason to think that we have touched the circumference of the astral sphere; or that we have advanced beyond the threshold of God's creation.

If it be objected that, in accordance with these deductions, we might expect new portions of Jehovah's dominion to be frequently disclosing themselves, stars and clusters of stars 'blushing out' on our view, new to us, because their light had now first arrived at our earthly abode, I conceive the following considerations sufficient to meet the objection:—

1. The absolute distances of fixed stars and groups from each other may be such as to require respective intervals of years and even centuries for the light of the more remote objects to reach us; that light arriving successively from each according to the distance.

2. Our case refers to objects which, though self-luminous, are not visible to the naked eye. They may 'blush out,' even frequently; but men are not capable of being their observers. Only a few of mankind can enjoy, and be qualified to use, such telescopes as those of Sir William Herschel, and his still more accomplished son.

3. Granting the possession of these advantages, the opportunities for observation are too scanty for the construction of a negative argument. Sir William Herschel, in the same paper, says that the number of night-hours, suited to this kind of celestial observation, is averaged favorably in our climate at one hundred in a year; and that to 'sweep'—to examine as rapidly as is consistent with astronomical attention—every zone of the heavens, for the two hemispheres, would require eight hundred and eleven of such favorable years. The number of the objects to be observed is great almost beyond conception. Sir William Herschel, by counting the stars in a definite portion of the field of view which he observed in one hour, and estimating the rest, concluded that fifty thousand passed under his review in that hour. It is therefore within the scope of probability that new masses of light are achieving their first arrival in parts of our telescopic sphere, frequently without its being possible for men to be aware of it; and, when any of them comes to be discovered, the date of their arrival is unknown.

I draw no argument from the fact that, within the short period of the last two or three centuries, stars have been discovered which earlier catalogues or descriptions had not noticed. The attention, requisite to give certainty in this matter, we cannot assume to have been exercised; and to look for evidence from this quarter would be forgetting that it can exist in the domain of only the greatest telescopic powers.

These views of the antiquity of that vast portion of the Creator's works which astronomy discloses, may well abate our reluctance to admit the deductions of geology, concerning the past ages of our planets' existence.—[Supplementary note to the relation between the Holy Scriptures and some parts of Geological Science. By Dr. Pye Smith.]

Nor ought it to be forgotten that these very principles and deductions of geology, that have excited so much of alarm and opposition among some friends of religion, and so much of premature and groundless exultation among its enemies, have nevertheless, when taken in connection with astronomy, developed and established a LAW of God's natural government of the universe, *grand beyond all others known to man*, and undiscovered or only dimly seen by the great minds of other generations. I refer to the fact, that *perpetual* CHANGE *is made the grand conservative and controlling principle of the universe*. Men have always seen and felt this instability in respect to everything on earth; and they have regarded it as a defect, rather than as a wise law of the natural world. But they now find it to be equally true of suns and planets not to display wonders, but while in passing we reply to objectors, we must continue to illustrate the leading purpose of these researches, really and truly the philosophy of mesmerism. Strange would it be if the wonders of clairvoyance; those of the phenomena detected by the telescope; the events accruing from the nature of living organisms, in all their infinite varieties, should finally be dependent on the same force, which Newton contemplated, in his acute conjecture that water was a compound body, and which gave rise to the wild but important speculations of Mesmer, on the existence of an universal fluid, when he led the way to the facts of a new science, which, after a struggle of eighty years, has emerged in the hands of Von Reichenbach into principles applicable to all nature.

A remarkable fact connected with the emergence of mesmerism into its present importance is the serious neglect of its merits which has marked the conduct of those who were bound to encourage them, by study and inquiry. Really, practically, mesmerism has deserved very different treatment. It has merited high civic honors. It has, under the patient philosophic guidance of Dr. Elliotson, conquered malignant cancer. It has removed enormous growths known as polypus, as I can testify. I know that it has chased away large ovarian tumors, and dropsies that have defied all medical skill. It has cured malignant fevers in their advanced stages. It has removed tubercles, and healed abscesses. To enumerate all the good that has been done by this agent, combined with the essence of human kindness—for without that the practice of mesmerism is useless—would take many volumes. Thousand of cases are now extant of the benefits derived from this holy power. The *Zoist* is the grand English work of testimony on this subject, and it is full of useful information, as well as of noble essays to advance the cause of humanity. The defenders of mesmerism have, in that work, labored hard for the truth, which they have advocated with the boldness belonging to sincerity. How much soever they have been opposed by the sordid and the mean, by those systematically opposed to the progress of expansion—with whatever success falsehood has retarded the march of useful knowledge—it is consoling to the writers in the *Zoist* to know that the great cause is advancing. Small-minded men, not capable, from unfortunate organization of brain, of believing in truths at variance with the idols they have been accustomed to worship, set themselves up as oracles of wisdom. Too many implicitly give up their convictions to such incompetent leaders! Fight, however, as they will against the truth, it is always too strong for its opponents. Time, which settles all differences, by changing old things and by bringing forward new, sweeps away the fallacies of the obstinately proud and ignorant. Would it were possible for small minds to reflect, that all their efforts to establish falsehood will not alter the laws of nature, and no folly of striving to prove that falsehood is truth can change these established laws! For nearly eighty years has the professional world of science opposed itself to the discovery of Mesmer, yet still the facts exist. Turn to the truths placed before mankind by the stupendous powers of observation and catenation of that rare genius, Gall! It is sickening to note the causes which have hitherto deprived society of the advantages, destined to accrue to our race, at a later period, by the cultivation of phrenology. How curiously and strikingly has mesmeric science verified all the discoveries of Gall! Still the flood of opposition pours on, and the pretenders to religion, real enemies of the *spirit of truth*, with awful pride and cunning, endeavor by sly arts to crush its rising lights.

as of plants and animals. Perpetual change, perpetual progression, increase, and diminution, appear to be the rules of the material world, and to prevail without exception.—[Professor Whewell, quoted by Dr. Pye Smith.] Burke might be quoted on the same subject, for with the acumen and terseness of Genius, he says in a letter to Sir Henry Langrishe, *Change is the great Law of Nature.*

It is remarkable that three great philosophers, each in succession, in some measure contemning the labors of his predecessor, should have arisen in the same spot; that each should have put forth a discovery of signal importance to the philosophy of mind; that Vienna should be the well-spring, whence these lights should radiate; that the sparkling, crystalline, luminous knowledge emanating from that fountain, placed in the central capital of European civilization, should have reflected a glory round the names of three philosophers, which will emblazon their researches as amongst the most important that can occupy the attention of mankind; that Mesmer, Gall, and Reichenbach, first announced their grand ideas from the capital of the Austrian empire.

The Baron von Reichenbach may not believe himself complimented by this allocation. He may have some scientific pride, notwithstanding the size and quality of the majority of the organs of his brain; nevertheless, the reflection must be made, that all knowledge is relative, as every atom of matter is relative. Nothing is fixed and absolute; but in the vast range of human acquirement, it would be difficult to exhibit three sets of facts, announced at separate intervals of time, having so intimate a relation to each other, and which are so interwoven in their dependencies, as those Viennese discoveries; having, moreover, such numerous alliances to all the circumstances to which man can, by turns, transfer his attentions.

Where will all this philosophy lead us? Can any sincere person entertain a doubt? It is the spirit of truth which is about to be victorious. It is not a question as to the appreciation, at the present moment, of the best knowledge, of the soundest philosophy. Educated in selfishness, we live in a world of hallucinations. It has been well said that we form one large lunatic establishment. We are surrounded by influences that are always tending to impress upon us a desire to succumb to the tyranny of falsehood. The conventional habits of our lives make us, more or less, hypocrites; and according to the energy, originality, or some other individual peculiarity of our character, we swerve from the leaning of our fellow-men. If the proposition be offered to his innate desire for justice, it is not that man does not essentially love truth, but that the progress of his organization, through ages, has not yet ripened sufficiently to allow that expanded development which, as science advances, must have place in a more perfect arrangement of society. Man cannot yet worship *truth as the best knowledge.* He has not yet passed the age of idols. The knavery of the selfish and interested is always ready to excite his lower feelings against that which is really holy and reverential, the sacred will of the Most Just. But the good time approaches —for science advances with immensely rapid strides. Those who are now young have to witness many improvements, all tending, like the researches of the Baron von Reichenbach, to expand the intellects and morals of man, and to lead him finally to the realms of light.

JOHN ASHBURNER.

65, Grosvenor Street, April 25, 1850.

THE AUTHOR'S PREFACE

TO THE

SECOND EDITION.

THE following treatises were originally destined to appear singly in the monthly parts of Liebig's "Annalen der Chemie," and should, from the time they were given in, have been commenced in July, 1844. Accidental circumstances delayed their publication, and thus it happened that several of them became united in entire parts of that work, and then were first given to the public in March and May, 1845. This will explain their somewhat unusual form.

In the present Second Edition there are some corrections, but, as a whole, the principal contents have remained unaltered; my researches, continued without interruption during the several years that have elapsed, have strengthened and confirmed the earlier observations. I have considered that I could not abandon the half-historical, half-systematic course of the enumeration of my observations, and the detail of my judgments upon them, since it is that of natural science generally, in which the correction of earlier experiments always keeps pace with the extension of our knowledge.

It was to be expected that a subject of so unusual and peculiar a kind as the present researches would meet with objections; and I was aware beforehand that I should have to defend my experiments, and the deductions I had drawn from them, against ill-founded and groundless opposition. The new field of research which was laid open pushes its lines too near the bastions of established formulæ, frequently involves, in too many convolutions, all that exists in the present doctrines of natural dynamics, for the necessary space to be freely allowed to it. Yet I thought only of *reasonable* criticism of my observations, perhaps of unsuccessful repetitions of my experiments, arising here and there from faulty arrangement; that my conclusions might be contested, or other views built upon the facts brought forward: but I was not prepared for an attack, which every true friend of science will unite with me in calling unprovoked, such as was made upon my work, and upon myself personally, by a Dr. Dubois-Reymond, in Kärsten's "*Fortschritte der Physik im Jahre* 1845." This naturalist does not find it at all necessary to go into my experiments, and the conclusions deduced from them, but briefly and superficially designates my book as an "absurb romance," the details of which "it would be fruitless and to him impossible to enter." I believe both of these assertions. Fruitless; because he has not understood them, and an uncomprehended and incomprehensible criticism is *fruitless*. Impossible; because he has not read them in connection; and to enter into a matter of which one has acquired no knowledge, is *impossible*. And that he really has not read them, but turned over the leaves in the fashion of a superficial and unscrupulous reviewer, is proved by his calling my work "the New Testament of Mesmerism:" thus he has not seen that it is the very first, in this field, which runs counter to Mesmer's views in most points, and places the phenomena on wholly different ground. With silly jests he says, he "is greeted by the magnetic tub and complex magic wares of the Baron von Reichenbach," &c.: thus he has not read that it is myself who makes an end of that tub and Mesmer's magnetic wares, in tearing down the veil from the mysteries, tracing them back to their bare physical contents, and replacing all previous phantasmagoria by sober investigation of nature. But as long as science exists, ignorance will have the most dogmatic judgment. This polished Berlinese then further pleases to throw common-places in my face, such as,—my treatise is one of the "most melancholy aberrations which have for a long time settled on a human brain;" they are "fables," which deserve "to be thrown behind the fire;" and more of the like learned vulgarity. Whoever assumes publicly to sit in judgment and pronounce sentence on a scientific work, is subject, first of all, to the duty of making himself thoroughly acquainted with its contents; he has, moreover, like every other judge, to support the decision with the motives upon which he believes he is justified in grounding the same. This duty is the more irremissible in him, that his judgment is but one-sided, and requires the control of public opinion, while the attacked party may, if necessary, take arms against it. But a slanderous criticism, which is not ashamed to strip itself of all these conditions, is nothing else, in one word, than literary insolence, and of such measure, that is perhaps unexampled in ancient or modern literature: for it certainly has never and nowhere occurred that a reporter has had the boldness, or rather the silliness, to pass over a scientific production peremptorily, and with unprovoked insults, without any account, or any statement of his reasons,—without a single syllable of analysis of its contents. I have said silliness, because it is silly to throw stones which one can see will rebound on one's own head. Either my statements contained truths, which have existence and consistence in the physical world,—consequently must sooner or later be recognised, and put the ignorant reviewer to shame; or they are based upon great errors, and in that case it must be an easy thing for him, in accordance with his duty, to disclose and elucidate them, and thereby to put away from himself the accusation of unfair trifling with the fame of his fellow-citizens: only, narrow-mindedness and silliness expose themselves thoughtlessly to both these dangers at once.

M. Dubois further says, he cannot enter into the details of my treatise, "because it would be altogether impossible for him to avoid unparliamentary language in so doing." The insolence he had poured out upon me was not unparliamentary, not rude enough; he had store of still coarser quality. He has given a specimen of the delicacy of his manners, which restrains him from the use of it. I will relieve him from the necessity of any hypocrisy, and tell the truth: *he had not the courage to venture on a discussion of the details of my treatises.* The matter does not lie upon the surface; the facts collected cannot be briefly set down by a fluent tongue; and the conclusions drawn consequently from them cannot be washed away with watery ink. A fundamental investigation, however, requires pains, and costs labor; this is inconvenient, perhaps fruitless, and perchance leads to scruples. And since, without such trouble, the matter cannot be thoroughly gone into, except at the risk of unripe judgments, the details are warily avoided, lest the critic should get rapped on the knuckles, or should subsequently be made to feel the scourge of the author. It is much easier and cheaper to skip away over the outside of a subject with a worthless superficiality, and by casting slurs upon it, to degrade it in public opinion, and then to shuffle out of it, in a cowardly way. M. Dubois need not lay the slightest compulsion upon himself to enter into the details of my treatise: I call him out into the arena, with his "unparliamentary language" of the Spree, and give him my word that he shall meet me, and I will give him just such an answer as he deserves.

The very nature of an experimental work renders it subject to defects; it is just *because* we feel these defects in our knowledge, that we institute experiments, to perfect it, through the discovery of new facts. While we are engaged in these, we again become aware of ten, nay a hundred, new deficiencies; the reader, too, on his part, probably discovers another dozen, which have escaped the author; and the reviewer perhaps still more. It is quite right, then, that they should be publicly indicated and be brought into discussion, so that the matters may be further worked out in new directions, or that what has already been obtained be safely placed beyond all doubt. This benefits every one, including the first discoverer of each new scientific fact.

My works will be as little free from defects as those of much more exalted men than I ever could be, least of all in the natural sciences. No one can have felt this more strongly than myself. Every criticism expressed in a good spirit I shall receive with thanks, and try to improve my work accordingly. But imperious abuse, from one who is profoundly ignorant of the work he reviews, must be repelled, and the reviewer must be taught to know the limits of decency. It is the interest, not only of myself, but of all who work and write, that weeds of this kind should not be left to flourish, but be raked out and cleared away.

That much more exalted men than myself do really fall into the greatest mistakes in their scientific works, I will not be content merely to have said, in my own defence, but I will at once prove it. M. Johannes Müller, our great physiologist, and the pride of Germany, whose excellent works are the oracle of his contemporaries, in his Handbook of Human Physiology (4th edition, i. 26,) where he mentions the "so-called animal magnetism, the passes, imposition of hands, transfer of the so-called magnetic fluid," says, word for word: "Their stories are, however, a *lamentable maze* of lies, deceit, and superstition; and it has only proved how incapable most physicians are of empirical investigation, and how little conception they have of a mode of examination which has become the universal method in the other natural sciences." But how, if it now turn out that it is, on the contrary, M. Müller himself who is and moves in that *lamentable maze?* How, if in my treatises exactly that mode of proof be applied which is carried out in the *now universal method of the other natural sciences?* And how, finally, if exactly *these tests* have demonstrated and established by evidence, through hundreds of facts, the actual existence of such a fluid or dynamic, that produces surprising physical and physiological effects, by *passes, imposition of hands, and transference*, as distinctly as any other physical or physiological truth can be established in the same way? Then, one would and must say, that the great Müller had considerably erred in a matter on which, without a previous examination, he had allowed himself to pronounce an injurious and hasty judgment, and that in a new edition of his Handbook he will expand those parts so hurried over. It will be noted as a striking instance of how the most distinguished men may fall into the greatest errors through prejudice or preoccupation; may be subject to mistakes of such magnitude, that exactly that which they bitterly and unsparingly attribute to other people, finds its most accurate application in their very selves, and falls back upon their own heads.

M. Dubois, meanwhile, is under the scientific influence of M. J. Müller, as he tells us himself in the 58th volume of "*Poggendorff's Annalen*,"—is indeed his pupil,—and thinks that in proper respect to his exalted master he must swear "*in verba magistri*," for it is evident that his attack, where he honors me with "the most melancholy aberration of a human brain," agrees almost *verbatim* with M. Müller's "lamentable maze," (both appear to have a store of compassion for lamentably erring authors;) and where the latter speaks of lies and deceit, the former thinks to hurt me with obscure and suspicious hints, as,—of concealed "peculiar and hidden ground of my treatise." . . . But these gentlemen "cannot see the forests for the trees" this time. An unconnected mass of the strangest phenomena, in nervous patients, is reported to them; there is no rubric for such facts in the "system;" and while the spectators were regarding the astonished faces and the embarrassment of the doctors, a Berlin grisette has made one of the learned gentlemen the sport of her wantonness. When he at last saw, in the mirror, that his ears were growing too long, he cried "Treason!" and all the thousand truths that now came crowding to the door for examination and recognition, were pitilessly hurled, unheard, from top to bottom of the stairs, as "lying, deceit, and superstition." This is, indeed, a convenient way of getting over the trouble of a fundamental investigation, but it is at the same time as one-sided and hasty, as unscientific and unconscientious.

Natural science, and all its branches, have originally run through a period of obscurity and error; physics were preceded by magic; chemistry, by alchemy; medicine, by the philosopher's stone; astronomy, by astrology, &c.; philosophy, theology, and jurisprudence, have passed through their phases of extravagance. Our first conceptions are always unclear, confused; hence adapted to the wonderful, the mysterious, and so on to superstition and misuse. But it does not follow from this, that the enigmatic shell conceals no solid kernel. It is quite in character with the matter, and anything but unexpected, that the subject of sensitiveness, and the peculiar force on which it depends, should have to go through such a period of infancy in our notions; and the more so in proportion as it shows itself, on the one hand, the less capable of limitation, and on the other, to have a deeper hold on the hidden sphere of the nerves. That these days of rudeness should have endured for seventy years, is really rather long in these enlightened times, but in great part owing to the almost criminal narrow-minded opposition of the gentlemen of the "exact sciences," who have turned to it, not only deaf ears, but even a kind of foolish hostility. Berzelius, who, as is known, accepted my researches with ardor, has assured me that for forty years he has always nourished the desire that some one would undertake this matter—which could not be groundless,—who would make it the subject of a special and fundamental examination, according to the present methods of investigation in the natural sciences; and he rejoiced at last to have found, in me, one who would make a rational inquiry into it. The reason why this has been so long delayed, why the groping round about has come to no end, lies moreover in the fact that people so often begin to build the pyramid at the point; they would wish to do first what they should do last—*undertake to cure diseases!* Before striving for the slightest knowledge of the inner nature of the hidden force, they made a trade of the matter! Then somnambulists and clairvoyants were met with, everywhere manifestations of force at its maximum, and in complication with inexplicable exalted conditions of disease. While struck with the phenomena on a large scale, and feeling unable to find an explanation of them, people neglected to inquire after the small beginnings, on which alone the basis of a scientific structure could be raised. Not from the lightning and the thunder have we gathered the theories of electricity and of sound; not from the eruption of volcanoes have we drawn our knowledge of the expansive force of steam; but just as our forefathers fabled about these natural phenomena, because they did not understand them, even so have the modern *savans* of the category to which M. Dubois belongs, talked nonsense about the so-called animal magnetism, because they did not know it. I will not speak of medical men, but it is no better with the physicists and physiologists; the majority of the former have rejected all cognizance of it, because they *cannot* understand the connection of cause and effect; and of the latter because they *will* not. However, this is not the path of the investigation of nature, and the offence against enlightenment is really greater in the latter than the former. It does not redound to the honor of our contemporaries to stand obstinately firm in that primitive condition of blind ignorance, and to refuse to see at all how monstrously they lay themselves open on this side.

Yet I have not found the difficulty of penetrating to the truth of these matters nearly so insurmountable as it is generally, timidly, asserted to be. All that gossip about lies and deceit is in reality quite misplaced: when we examine more closely, it lies essentially not in the sensitive, but, on the contrary, in the subjectiveness of the pre-occupied, or not unfrequently incompetent inquirer. One must understand how to investigate, one must know how to question nature, if one would obtain a clear and instructive answer; but it is not every one who can do this, so far as we know. I must say it, to the credit of the mixed population of Vienna, that among some hundreds of persons whom I have, up to this time, received more or less deeply into the sphere of my researches, and sixty of whom are publicly named in my writings, that there was scarcely a single one who gave me more than one or two exaggerated answers, and this rather from misapprehension than from dishonest intention, but which were immediately discovered and reformed by me. From the intimate, natural, and regular connection in which all these phenomena stand with each other, the threads of which I now hold surely in my hand, it is impossible for any one to continue to answer me falsely, even for a few minutes, without my at once detecting it. None of these people think of lying and deceiving; they simply express what they see and feel, when I react upon them; most of them evince a sincere and encouraging desire to make as clear as possible, to me, what they perceive and detect, in which zeal I find some compensation for the mortifications from parties who ought rather to feel that they have reason to be thankful for my endeavors. All these almost countless answers to my questions agree in every case so perfectly, that all reasonable doubt must disappear before the evidence of the truth; and in this beautiful agreement lies the warrant of their thorough credibility. When, however, the inquirer does not know how to put the questions, from want of skill how to manipulate with the apparatus, from ignorance of the conditions how to arrange the experiments, from want of tact to comprehend the answers, and from want of acuteness of understanding how to discover the relations of the observations to each other: then confusion and perplexity begin, misinterpreted results contradict each other; and rather than look in the face his own weakness, and confess it to himself and others, he, a thousand times sooner, takes the dishonest subterfuge of accusing the observed person of deceit. But the betrayer of nature and science is no other than the man who, from incapacity, has the rashness and foolishness to desire to stamp the truth with the mark of a lie.

REICHENBACH.

Castle Reisenberg, near Vienna, February, 1848.

THIS work was already completed and printed in the spring of last year, but the occurrence of the German revolution threw obstacles in the way of its publication. These are now removed, and communication is re-established. It was necessary to make this note, in order to enable the reader to understand some dates which occur in the book, and which could not be reprinted. R.

DYNAMICS

OF

MAGNETISM, ELECTRICITY,

&c.

INTRODUCTION.

If a strong magnet, capable of supporting about ten pounds, be drawn downward over the bodies of fifteen or twenty persons, without actually touching them, some among them will always be found to be excited by it in a peculiar manner. The number of people who are sensitive in this way is greater than is generally imagined: sometimes three or four are met with in such a number as above mentioned: indeed, I know an establishment where the experiment was tried, and of twenty-two young ladies who were collected there no less than eighteen felt more or less distinctly the passage of the magnet. The kind of impression produced on these excitable people, who otherwise may be regarded as in perfect health,* is scarcely describable; it is rather disagreeable than pleasant, and combined with a slight sensation either of cold or warmth, resembling a cool or gently warm breath of air, which the patients imagine to blow softly upon them. Sometimes they feel sensations of drawing, pricking, or creeping; some complain of sudden attacks of headache. Not only women, but men in the very prime of life, are found distinctly susceptible of this influence; in children it is sometimes very active.

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* What is meant by this expression? Ordinary health would be more consonant to the Baron's meaning. Great or even modified impressionability is not a condition of perfect health. A nervous system which gives a proclivity to disorder from keen susceptibility to external impressions, is not one which belongs to an organism in every part of which the configuration is the most convenient for the perfect performance of the functions to which that organism or any of its parts is destined. Perfect health belongs only to a body in which no part is unduly developed. A law exists which establishes the fact that every undue development of a part is at the expense of some other part; and it will be found, in endeavoring to establish most incontrovertible facts, that all individuals who have an impressionable nervous fabric are the subjects of more or less imperfect development. At page 3, the Baron says, "vigorous men and healthy women usually feel nothing of these sensations." Sedentary occupations, and a variety of the circumstances surrounding man in his present imperfect state of civilization, render him more impressionable, because they irregulate and unbalance the harmony of his system. It is more difficult to induce anæsthesia, or any of the nervous states analogous to it, in a perfectly healthy and vigorous person than in one who is susceptible of the influence of those poisons which unbalance the accounts between the two systems of blood-vessels.

To produce this effect, it is essentially indifferent whether we use a horse-shoe magnet or a straight iron bar, with either pole, if it be but strong enough and possess something like the sustaining power above mentioned. The passes must be made from head to foot, and not with too great rapidity. The magnet must be carried as near the body as possible without actually touching the clothes; and to ensure the absence of deception on either side, the pass may be made downward from the back of the head over the neck and back. The person magnetized is then unaware of the passage of the magnet, and his movement must be unconstrained.

Vigorous men and healthy strong women usually feel nothing of these sensations. Nevertheless, I have met with individuals who

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A man in the last stage of typhus, or the fever of unhealthy venous congestion, may be saved by mesmerism, as has happened in several cases; while in a person under the condition of perfect health the mesmeric passes produce little or no effect for a great length of time. It is the same with the impressionability to magnets. Those who feel the influence of the magnet are in a *greater* or in a *less degree* in the same category of the imperfectly developed and unduly balanced. "The sensations of drawing, pricking, or creeping," from the application of the hands to a strong magnet, which I caused to be *repeated* daily in two impressionable cases, terminated in one in rigidity and deep mesmeric sleep in four days; in the other, in nine days.

Since the above was written (24th of March, 1850), I have a strong corroboration of the view given in this note. A young woman had applied to me six weeks ago for a set of symptoms which indicated great debility. She had passive hemorrhage, under which, complicated with hysteria, leucorrhœa, &c., she had labored for some months previously. It was a case which mesmerism would have cured rapidly. I tried some passes; the pupils dilated, and other symptoms of mesmeric sleep were present. She felt a warm air from the large magnet. I tried the pointed end of a large crystal, which made her very sleepy. At last I put her to sleep by the gaze. She awoke in an hour, refreshed and strengthened. Finding that she could not be mesmerized at home, I prescribed a solution of persulphate of iron in diluted sulphuric acid, to be taken three times a day. I find she has strictly attended to my directions, and she is quite well, with a healthy florid complexion. I try her with the same large magnet, and she experiences no sensation. I try for half an hour to make her sleep mesmerically: in vain. The pupils of the eyes refuse to dilate. She says if I proceeded with my experiments she is sure I should make her head ache. Here has been a clonic state of system, in which the nerves and blood-vessels have induced "a temporary derangement of organization," in which some parts have suffered a while at the expense of others, in which a "*sick sensibility*" has supervened, in which the individual has become unduly impressionable, and in which restored health has removed the liability to be influenced by magnetism and by mesmerism.

have been distinctly affected by the passage of the magnet when in the full enjoyment of health, and these, active light-hearted men and women. But the excitability presents itself more frequently in people of sedentary habits, who may otherwise be considered as healthy, especially in men who are occupied continuously in writing, or girls who pass the greater part of their time at needle-work; moreover, in those who are depressed by secret troubles, anxiety respecting their means of support, neglect, or the loss of relatives. Next to these imperfectly healthy, the slightly diseased are very frequently the most sensitive to the magnet, especially those persons of whom it is commonly said they suffer from weak nerves, who are readily frightened, or have received a shock from some fright they have experienced; besides these, the truly sick in innumerable cases, especially in those whose complaints are accompanied by local or general cramps; during abnormal developments of puberty; many hypochondriacs, valetudinarians as they are called; persons who are very disagreeably affected by odors; but above all, those suffering from catalepsy, St. Vitus's dance, palsy, many of the hysterical, and lastly, those who walk in their sleep, and the true somnambulists without exception. Thus from the healthy person to the sleep-walker a chain is formed, at one end of which stands a powerful man, and at the other a weak somnambulist. Any one may readily convince himself of those facts in every large hospital.

The magnet thus declares itself as *a general agent upon the vital principle ;* a property of it which individual physicians have indeed endeavored, though as yet without solid results, to bring into more extensive application, in reference to the possibility of deriving from it a curative treatment in cases of disease,—which, however, has not yet been received by natural philosophers into the realm of physics; and from the uncertainty of the observations, hitherto, has been altogether passed over by natural science generally. Nevertheless, magnetism, when more closely examined, presents an infinitely varied and exalted interest on this side. If a portion of the phenomena here assert an influence upon life, this occurs exactly and especially at the point where the boundaries of the organic and inorganic are intermingled. Since a doubt exists whether it shall be attributed to the domain of physiology or of physics, it is neglected on both sides. Thus it is left over to medicine, and has not always fallen into the best hands there. I hope, in the following pages, to disentangle some of the threads of this knot, and to combine a number of phenomena under a common point of view, at the same time arranging them under fixed physical laws.

FIRST TREATISE.

LUMINOUS PHENOMENA AT THE POLES AND SIDES OF STRONG MAGNETS.

1. SENSITIVE persons, who are actually or apparently healthy, perceive nothing particular in the magnet beyond the excitement above mentioned, and bear the circuit of it without injurious influence. But this is not the case with the sick sensitive.* The effect

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* There are many persons in the category of the *sick sensitive* upon whom, in England, these experiments have been repeated, and they have not *always* exhibited the phenomena detailed. In affording a most willing and respectful testimony corroborative of the greatest part of the facts reported above, whenever I have had it in my power to repeat the experiments with strong magnets, I nevertheless believe it to be of importance that the class of the sick sensitive to whom these facts are applicable should be more strictly defined. I have no doubt that many of the individuals above described could be most easily mesmerized into sleep; and of those who would not readily sleep, some would probably, by repetitions of mesmeric passes, be rendered more favorable for the development of the phenomena which the Baron has noted. The very impressionable conditions sometimes present without sickness or disease is not one of perfect health—certainly not usually of vigorous health; but there are many states of disease in which that impressionability not only does not exist, but in which a sensitiveness of *some organs* is present without any of others. If it be absolutely necessary to yield to party considerations for the sake of advancing truth by a side route; if it be requisite to assume, in order to meet the silly prejudices of the ignorant, that experiments of the nature described in the text are valueless unless they be performed upon persons *awake*, who happen to have "*an extraordinary exaltation of the sensuous perceptions*," then many of the very numerous corroborations here, of the facts established by the Baron Von Reichenbach in Vienna, must be thrown aside. But I am inclined to contend for their value; and no one can read the review in the 4th volume of the *Zoist*, by Dr. Elliotson, of the Abstract of the Baron Von Reichenbach's Papers, by Professor Gregory, without being struck by the strong analogies adduced from mesmeric experience of the Baron's facts. When it becomes more known that the mesmeric condition is simply a state of nervous system, sometimes artificially produced, sometimes spontaneously present, of an "*exalted sensuous*" state, or the *very reverse*, and that at pleasure, in many individuals, can be produced those conditions which the Baron endeavors to indicate at pages 6, 7, 8, there will be no more hesitation in preparing a mesmeric test than the chemist now experiences in producing a litmus test. The truth is, that we are at all times, while life remains in us, in a mesmeric condition, each varying in degree; and without the agency of the mesmeric forces we neither think, nor move, nor have our being.

It is a want of sufficient reflection on the use of terms that leads us astray from clear ideas on the various conditions of the nervous system. Because the matter has not been studied as it ought to be, the Baron Von Reichenbach deprecates experiments on subjects who have been mesmerized. Suppose, which is actually the case, that the same phenomena are offered to our observation in the persons who upon these is either pleasant, unpleasant, or fearfully adverse, according to the nature of their disease; and the last sometimes to such a

have been made, by artificial expedients, highly sensitive—very impressionable, the facts are really just as valuable as if they had been displayed in those naturally impressionable. The only question is as to the numbers of mankind readily influenced to exhibit phenomena which prove the existence of the Baron's new force. If all men could conduct investigations as logically, as clearly, as philosophically as the Baron, we should now have it in our power to arrange the characters of each condition of the nervous system in an unmistakeable category. They would easily be tabulated. They would present a very interesting series. I have attempted to sketch my meaning in Essays on Mesmeric Phenomena, and on the Theory of Sleep (Zoist, Vol. iv.) Whatever may hereafter prove to be the varieties of the states in which individuals may be, when aberrant from the condition of "perfect health"—a condition upon the definition of which physiologists as yet might not agree—it is clear, to those who have studied this matter, that the gradations in the series of the phenomena have some connection with attraction and repulsion. If I observe in a hospital a patient who, in result of an accident, has been deprived of a portion of the frontal or parietal bone of his skull, so that the brain is exposed, I shall find, what Boerhaave long ago found, that this viscus, during sleep, occupies less space than in the vigilant condition. The particles of brain-matter are approximated, and an attraction is active among them. If this patient be awake, and I apply very gentle pressure on the surface of the brain, I induce a tendency to sleep. If I increase the pressure, I occasion coma; I continue to increase, and the stertor accompanying coma may cease, but the nervous condition is one of tonic spasm. The simple paralysis goes on to a rigid condition of the muscles. Convulsions supervene when the surface of brain pressed upon is not extensive enough, because partial irritation is produced upon certain nerves. I have made these experiments on several human beings; but the fairest mode of obtaining accurate results is to expose the brain in a rabbit, cat, or dog. Tickle the brain with a soft brush, and clonic spasms ensue. The brain appears to swell out, it occupies more space under irritation, and is subjected to a repulsive agency among its particles. So that the state of sleep and of coma, quietude, paralysis, rigid tonic spasm, are degrees of a condition influenced to exist under attraction; the state of vigilance, restlessness, activity, agitation, clonic spasm, are varieties of a condition influenced by repulsion. In "perfect health," there is no extreme state of attraction or of repulsion. But if health be disturbed by some poison, the inconvenience produces an improper state of the balance between the attractive and repulsive forces; the brain and nerves influence a want of due balance in the arterial and venous systems. With arterial fulness there is inflammation; with venous fulness there is congestion. The degrees of variety in nervous phenomena dependent on these opposite states are very numerous; but still a law exists which we have yet to trace out. The varieties of those nervous phenomena called psychological, closely allied to the varieties of the conditions of the arterial and venous systems, fall particularly as subjects of inquiry into the province of the student in mesmerism and phrenology; and the satisfactory solution of many problems suggested by facts in the text of the Baron Von Reichenbach can never be arrived at without arranging all the gradations of facts belonging to the nervous system, under a scale of which the extremes are the deep tonic, and the deep clonic spasms. Complicated as the human nervous system becomes by the many varieties in cerebral structure offered by varieties in development of size, delicacy, or coarseness, and other characters and relations of phrenological organs, there nevertheless exist certain salient pathognomonic signs by which to establish the distinctions on which logicians may reason with accuracy; and in time it will be found that the condition of sleep mixed up with the second consciousness usually accompanying the modified waking state (the sleep-waking of Elliotsòn) is no obstacle to the attainment of truth in such experiments as those instituted by the Baron Von Reichenbach. Indeed, one is sometimes convinced, in reading his details of experiments, that, however strenuous he is to avoid the imputation of mesmerism, he is all the while describing facts degree that fainting, cataleptic attacks, and cramps, arise of such violence that they may at last become dangerous. In the latter cases, among which somnambulists also are found, *an extraordinary exaltation of the sensuous perceptions* is usually met with; the sick smell and taste with uncommon delicacy and acuteness,—many kinds of food become as insufferable to them as the at other times most pleasant odors of flowers become disagreeable; they hear and understand what is spoken three or four rooms off, and are often so sensitive to light that, on the one hand, they cannot bear the light of the sun or of a fire, while, on the other, they are able, in *great darkness*, not only to perceive the *outlines of objects*, but to distinguish colors clearly, when the healthy can no longer perceive anything. These things are to a great extent well known, and require no further proof here. The intelligibility and possibility of them are by no means so far off as they appear, at first sight, to many who mistrust all such things as supernatural or incredible. Not only do most animals surpass civilized man in the delicacy of particular senses, but savages—therefore man himself—not unfrequently equal dogs and other animals in smell and hearing: as to sight, horses, cats, and owls are ready examples of capacity to see tolerably well with the optical apparatus in dark night.

2. Through the kindness of a surgeon practising in Vienna, I was introduced, in March, 1844, to one of his patients, the daughter of the tax-collector Nowotny, No. 471, Landstrasse, a young woman of 25 years of age, who had suffered for eight years from increasing pains in the head, and from these had fallen into cataleptic attacks, with alternate tonic and clonic spasms. In her all the exalted intensity of the senses had appeared, so that she could not bear sun or candle-light, saw her chamber as in a twilight in the darkness of night, and clearly distinguished the colors of all the furniture and clothes in it. On this patient the magnet acted with extraordinary violence in several ways, and she manifested the sensitive peculiarity, in every respect, in such a high degree, that she equalled the true somnambulists (which she herself, however, was not) in every particular relating to the acuteness of sensuous irritability.

At the sight of all this, and in recalling to mind that the northern light appeared to be nothing else but an electrical phenomenon pro-

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occurring in what is commonly and vulgarly called the mesmeric state. Here is the mischief of the want of definite terms. Certain events occur in a condition of the nervous system accompanied by full vigilance, identical with those which take place in the condition of sleep-waking. The Baron is quite content with the fact in vigilance, but thinks that in sleep-waking unsatisfactory. Deeper reflection and further experience would convince him that in a vast majority of cases, as a testing meter, the state of sleep-waking is the more complete—the more delicate.

duced through the terrestrial magnetism, the intimate nature of which is still inexplicable, in so far that no direct emanation of light from the magnet is known in physics, I came to the idea of making a trial whether a power of vision so exalted as that of Miss Nowotny might not perhaps perceive some phenomena of light on the magnet in perfect darkness. The possibility did not appear to me so very distant, and if it did actually present itself, the key to the explanation of the aurora borealis seemed in my hands.

3. I allowed the father of the girl to make the first preparatory experiment in my absence. In order to profit by the greatest darkness, and the maximum dilatation of the pupil, from the eye having been long accustomed to the total absence of light, I directed him to hold before the patient, in the middle of the night, the largest existing magnet, a nine-fold horse-shoe capable of supporting about ninety pounds of iron, with the armature removed. This was done, and on the following morning I was informed that the girl had really *perceived a distinct continuous luminosity* as long as the magnet was kept open, but that it disappeared every time the armature was placed on it.

To convince myself more completely, and study the matter more closely, I made preparations to undertake the experiment with modifications myself. I devoted the following night to this, and selected for it the period when the patient had just awakened from a cataleptic fit, and, consequently, was most excitable. The windows were covered with a superabundance of curtains, and the lighted candles removed from the room long before the termination of the spasms.

The magnet was placed upon a table about ten yards from the patient, with both poles directed toward the ceiling, and then freed from its armature. No one present could see in the least; but the girl beheld two luminous appearances, one at the extremity of each pole of the magnet. When this was closed by the application of the armature, they disappeared, and she saw nothing more; when it was opened again, the lights re-appeared. They seemed to be somewhat stronger at the moment of lifting up the armature, then to acquire a permanent condition, which was weaker. The fiery appearance was about equal in size at each pole, and without perceptible tendency to mutual connection. Close upon the steel from which it streamed, it appeared to form a fiery vapor, and this was surrounded by a kind of glory of rays. But the rays were not at rest; they became shorter and longer without intermission, and exhibited a kind of darting rays and active scintillation, which the observer assured us was uncommonly beautiful. The whole appearance was more delicate and beautiful than that of common fire; the light was far purer, almost white, sometimes intermingled with iridescent colors, the whole resembling the light of the sun more than that of a fire. The distribution of the light in rays was not uniform; in the middle of the edges of the horse-shoe they were more crowded and brilliant than toward the corners, but at the corners they were collected in tufts, which projected further than the rest of the rays. I showed her a little electric spark, which she had never seen before, and had no conception of; she found it much more blue than the magnetic light. It left a peculiar lasting impression on the eye, which disappeared very slowly.

The interest with which the subject necessarily inspired me, made me wish to multiply my observations, and to test them by repetition and by carrying them further out. The patient had already began to recover; her irritability diminished daily, and there was therefore no time to be lost. Two days after, I joined her relations in a resumption of the experiment. It proceeded exactly in the same way and with the same results. Allowing a day to elapse, we repeated the experiment in the first instance with a weaker magnet, without informing her of the alteration; the observer did not see the phenomenon in the same manner now as at first, but only perceived what she called two fiery threads.* These were evidently the edges

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* In repeating these experiments with persons of great impressionability, I have not been so fortunate at any time as to witness in a wide-awake person any other phenomenon than the appearance of one or sometimes two fiery threads, said to have been seen, in a room perfectly darkened, emanating from the poles of a powerful horse-shoe magnet. Some ladies have clearly distinguished these beautiful bluish threads of light proceeding upwards to the height of a foot or more. Some have seen a hazy cloud at a little distance on each side, "like that of a wet *moon.*" One gentleman saw a hazy light very distinctly; another something like a piece of red-hot iron wire, varying from six inches to a foot in length. These persons were brought into my dining-room, which had been previously darkened and prepared, without being informed of the purpose for which they were introduced.

Into the same room, and under the same conditions, I have introduced persons who instantly fell asleep, became clonically convulsed, and passed rapidly into the deeply rigid or tonic spasm, so that I have withdrawn them into another room while they have been as stiff as if they were frozen; and there I have gradually produced a relaxation of the muscular system, and complete wakefulness, by the application of unmagnetized iron to the nape of the neck and to the soles of the feet. Some individuals under these experiments wake up by the ordinary mesmeric manipulations, remaining fixed with tonic spasm until I applied the unmagnetized iron. In the same individuals, twelve in number, I have produced the same phenomena without the previous clonic spasm, by touching the nape of the neck with pure gold, or with platinum, or with rhodium, or with nickel, or with cobalt, or with antimony, or with bismuth. In every case, except in one (M. A. D.), I was always able to dissipate the spasm and awaken the patient by means of iron applied to the nape of the neck. In that one—the case will be well remembered by Mrs. Charles Lushington and by Dr. Thomas Mayo, who were present—I held a newly-cast disk of cobalt about two yards off, without the patient's knowledge, directed towards her back. She fell forward insensible upon Mrs. C. Lushington, who was talking to her. She was rigid and insensible. The pulse was for a time imperceptible. A of two poles of the magnet, which were all that her eyes could perceive of the weaker luminosity. When we then opened before her the stronger 90lbs. magnet, she at once recognised the former luminosity, of the form and color already known. After another interval of several days, during which her convalescence had greatly advanced, we renewed the experiment; but the light no longer made its appearance, even with the large magnet. The patient saw it less distinctly than before, smaller and rather unsteady: often it seemed to sink, then to brighten up again; sometimes almost to disappear, and then after a short time to return again. On the following evening she perceived in the large magnet only the two luminous threads; and the night after, the phenomenon was so imperceptible to

current from a single-coil electro-dynamic apparatus, which happened to be in action, was passed from the pit of the stomach to the nape of the neck. Color gradually returned to her cheek, and her pulse and breathing removed our alarm. She slept on that occasion fifty-six hours. A fortnight afterwards I was induced to repeat the experiment, and she slept forty-seven hours. If I endeavored to awake her by mesmerism, I found her idiotic, and I restored her to the influence of deep sleep, out of which she always awoke spontaneously, much refreshed and improved in vigor. This experiment, repeated in this case very often, has been attended with beneficial results to the patient's health; but she now never sleeps under the cobalt influence more than three hours. I have performed many of the Baron's experiments with magnets of different numbers of layers and with various powers. When the subjects of the experiments remain in the sleep-waking state, they describe almost exactly what the Baron has stated as fact regarding Miss Nowotny, and his other cases.

For some remarkable experiments with a large apparatus thirty-three inches high, made of iron wire a quarter of an inch in diameter, coiled fifty-six times in a circumference of eight feet, I refer to page 187 of the 4th volume of the *Zoist*. This coil was of an oval form, so constructed in order to enable me to place it with ease over any individual seated in an arm-chair. By means of one, two, three, or four of Smee's elements, each ten inches by five, a more or less powerful current was established, enabling me to use a magnetic force adapted to different susceptibilities. For nearly six months daily, for two hours, a nervous, highly sensitive, and strumous young man, aged 17, who had been twelve or thirteen years lame from an ununited fracture of his right leg, used to sit within this coil urged by four pairs of Smee's plates. He never was sensible of any light or of any cloud. He was very somnolent, but became wide awake again on being removed from the magnetic influence. Under this treatment he became stronger, and the bones of his leg were united. Acupuncture was occasionally practised where the local appearance indicated the measure. If, when he came out of his cage, he went into the next apartment, where six or seven young women were waiting, he touched any of them, instantly sleep and rigidity supervened. Sometimes in sport he would touch every one of them, and leave them all in deep sleep. I have myself often obtained this same result in various persons, male and female, who, being of impressionable constitutions, have gone into a deep sleep upon my touching them, after having in another room, without their knowledge, rubbed my hands upon the poles of a powerful magnet. I have notes of three lads, of different ages, cured of epilepsy by mesmerism, who could be instantly put to sleep and rendered rigid in this manner. Dr. Elliotson's celebrated case of cancer cured by mesmerism, became rigid on touching a magnet. I know three different females so susceptible of magnetic influence that they are made ill, being seized with painful spasms, if I bring a middle-sized magnet concealed in my coat pocket into the room. These persons do not know each other.

her vision that she beheld only two flashes, vanishing rapidly like lightning, which appeared and disappeared every time the armature was pulled off.

4. So far Miss Maria Nowotny. Her rapidly increasing health had now so far lessened her sensitiveness that no further experiments were practicable, or productive of new results. I had every reason to consider her statement as true and exact, since she was an intelligent girl, and, for her station, well educated and sensible; at the same time, to give it certainty and scientific reality, it was indispensable to seek about for corroboration from other quarters. Through the present investigations I had become acquainted with an accomplished physician, Dr. Lippich, House Physician to the Hospital, Clinical Professor in Ordinary in the Vienna University, and by his kindness I was introduced to a patient lying under his treatment in the hospital. This was Miss Angelica Sturmann, nineteen years of age, daughter of an inspector of farms in Prague, suffering from tubercular affection of the lungs, and long subject to somnambulism in its slighter stages, with attacks of tetanus and cataleptic fits. The influence of the magnet displayed itself so powerfully in her, after a few experiments, that she far surpassed Miss Nowotny in sensitiveness. When I stood in the darkened ward, holding the 90lb. magnet open at a distance of six paces from the feet of the patient, while Professor Lippich stood beside her, and she was previously perfectly conscious of what was going on around her, the patient ceased to answer. She fell into tetanic spasms and complete unconsciousness, from the action of the magnet, immediately I had pulled off the armature. This did not hold out a very hopeful prospect of the results of my experiments; but they were not in vain. After a while the girl came to herself again, and said that at the moment I removed the armature from the large magnet she had *seen a flame flash over it*, about the length of a small hand, and of a white color mingled with red and blue. She had wished to look at it more closely, when suddenly the action of the opened magnet took away her consciousness. I had an intense desire to repeat the experiment, to obtain more exact information of the circumstances. The patient, also, was perfectly willing; but the physician considered it injurious to the complaint of his patient, and I was therefore forced to abandon any further investigation of the matter. At the same time, I had attained my principal aim: a confirmation of Miss Nowotny's statements respecting the luminosity over the magnet was obtained: it had now been seen by a second person suffering from quite a different disease, without any communication with the first.

5. In another ward of the hospital, Dr. Lippich took me to a

young lad of some eighteen years, a journeyman glover, suffering from intermittent spasms, produced by fright and ill-usage. When I approached him with the magnet he at once spoke of *fire and flames appearing before him*, and which returned every time I removed the armature. But the lad was so uneducated that it would have been impossible to make any accurate experiments with him; and in the meantime I found more interesting opportunities of tracing out my subject in detail.

6. Miss Maria Maix, 25 years old, daughter of a groom of the chambers in the Imperial Palaces, residing at No. 260 in the Kohl-market, was the next person who was brought to me, through the kindness of her physician. He was treating her for a paralytic affection of the lower extremities, with occasional attacks of spasms. She was neither a somnambulist, nor did she talk in her sleep; she had never experienced any attacks of insanity, and was in all respects a young woman of clear good sense. When a large magnet was opened before her in the night time, which was often done, *she always immediately beheld a luminosity over it, resting on the poles*, about a hand's breadth in height. But when she was laboring under spasms, the phenomena increased most extraordinarily to her eyes. She then saw the magnetic light, which now appeared greatly increased in size, not merely on the poles, but also *perceived rays of light flowing from all over the outer sides of the steel*, weaker indeed than at the poles, but spread universally over the whole horse-shoe, which appeared as a bright light, and, as in the case of Miss Nowotny, left a dazzling brightness before her eyes, which would not disappear for a long time. We shall see the meaning and connection of all this. Meantime I had now obtained the fourth confirmation of the observation of the magnetic light. But by far the most remarkable and clearest of the observers was yet to come.

7. This was Miss Barbara Reichel, 29 years old, stoutly made, daughter of a servant in the Imperial Palace at Laxemburg. When a child of seven years, she had fallen from the window of the second floor of her dwelling, and from that time forward had suffered from nervous attacks, which passed in some degree into true somnambulism, and into talking in her sleep, and wandering in her dreams. The complaint was intermittent, coming and going at long intervals. The girl had just recovered from a violent spasmodic attack, but still retained all the irritability of her sharpened power of vision. She was at the same time quite strong, clearly conscious, looking well, and, moreover, walked alone through all the bustle of the town, to visit her relations. I invited her to my house, and received visits from her as often as I wished, in order to make use of her extraordi-

nary sensitiveness to the magnet, in investigations with physical apparatus which could not well be taken to other houses.

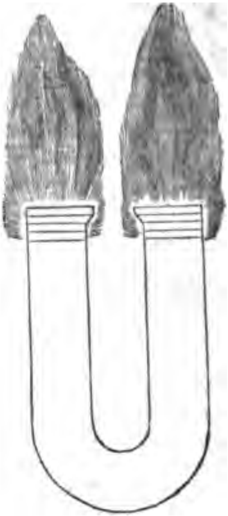
This person united in herself the rare gifts, that she saw the magnetic light as strongly as any exhausted, helpless, sick patient, while she was outwardly healthy, active, and sensible, and that, with the greatest sensitiveness to the luminous appearances, she could bear the circuit of the magnet almost as well as a healthy person; which, with most of the sensitive, as we have an example of in Miss Stürmann, and as also occurred in a slight degree in Miss Nowotny, is so far from being the case, that an open magnet is liable to throw them into convulsions, and even render them senseless. Little can be done with such; but with Miss Reichel I could follow every investigation quietly to the end. Individuals like her are invaluable for scientific inquiries: and thus I have through her been able to obtain most valuable elucidations of the electro-magnetic theory. In this place I shall in the first instance only indicate those observations which relate to the emission of light from magnets.

She saw the magnetic light not only in darkness, but in the dim light which I required to perceive all objects, and thus manipulate, to modify, and repeat the experiments. If the obscurity was moderate, the magnetic light appeared shorter and smaller, she saw less of it; that is, those parts in which the light was weakest were first overpowered by day-light; but she saw the flaming effluences most brilliantly, their size greatest, their definition sharpest, and the play of color most distinct, when the darkness was perfect.

8. When a magnet was laid before her in darkness, she saw *it emit light, not merely when open, but when it was closed, like a horse-shoe, by the armature.* This may at first sight appear surprising; but the sequel will show that this statement of the observer corresponds perfectly with the intimate nature of the matter. The two luminous pictures were naturally different in every respect. On the closed horse-shoe she could not detect any place at which the flaming appearances were especially concentrated, as they were at both poles when it was open; but the magnet emitted from all its edges, points of junction of the plates, and angles, a short flame-like luminosity, with a constant undulating motion. With a horse-shoe composed of nine layers, capable of supporting ninety pounds, this was not longer than about a finger's breadth.

9. When the horse-shoe was opened, it exhibited the beautiful appearance represented in fig. 1. The drawing was prepared by Miss Reichel herself, as well as she could execute it; but she lamented that she was not able to attain an exact imitation of nature. While an arm of the horse-shoe measured ten inches, the flaming light reached

FIG. 1.



up almost to an equal length, and arose of greater breadth than the steel. At every break formed by the layers of the magnet, smaller flames stood around the edges and angles, terminating in sparkling brushes. She described these little flames as blue, the main light as white below, becoming yellow above, passing then into red, and terminating at the top with green and blue. This light did not remain still, but flickered, waved and darted continually, so as to produce, as it were, shooting rays. But here also, as had occurred in the observation of Miss Nowotny, there was no attraction, no intermingling of the flames, not even an indication of a tendency to this, from pole to pole; and as there, too, no observable distinction between the condition of the two poles of the horse-shoe. Fig. 2 gives a side view, in which a separate tuft, of a lighter, flame-like appearance, spreads out from the edge of each component layer of the magnet. This was necessarily omitted in fig. 1, for the sake of distinctness. Along the back and inner sides of the steel, weaker lights streamed out universally, like those which had been partially described by Miss Maix; on the inside they were all curved upward, but on the outside they were only turned upward for a short space, then were straight for a moment, and next took the directly opposite direction downwards. They were shortest at the lowest part, on the curvature of the steel; therefore on the magnetically indifferent space. These shorter weaker rays are very delicate, and also more fixed. They are drawn from a single layer of steel, in fig. 10. The condition of the luminosity along the four longitudinal edges of each of the nine layers of steel fitted upon one another, is worthy of remark. At places where the edges of two lamellæ are accurately and closely fitted alongside one another, and almost form a continuous line, they were still clearly distinguished by the emission, on each side, of lines

FIG. 2.

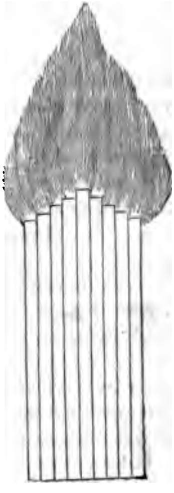
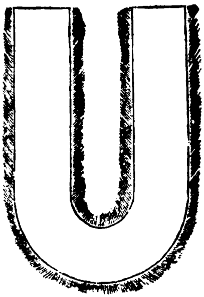
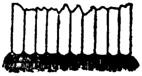


Fig. 10.



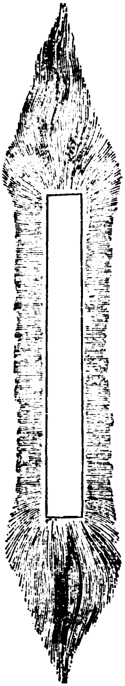
of flame, which one must suppose were necessarily confluent at the bottom. Directly above their point of origin they diverged, consequently converged toward the other lateral radiation of the same lamella; whence it follows, that a transverse section would exhibit such a figure as is represented in fig. 3.—Weaker magnets, from which Miss Reichel made drawings, gave the same picture, but the emitted rays were shorter.

FIG. 3.



10. I laid before her a straight magnetic rod. It was about 1½ feet long, quadrangular, and about 1½ inches broad, like common bar iron. She made from this the drawing subjoined in fig. 4. At the pole directed towards the north, therefore at the negative end of the magnet, she saw a large flame; at the opposite, positive end, a smaller, about half as large, waving, dancing, and shooting out rays, as in the horseshoe, red below, green in the middle, and blue above. From each of the four edges of either polar extremity issued a strong light, each independently flowing out at an angle of 45° to the plane of the base, and having a somewhat rotatory motion, not exhibited by the chief, central, flickering flame; thus there was a twofold distribution at each pole. A similarity exists in the statements of Miss Nowotny, who also perceived a stronger and more elongated flame at each solid angle of the horse-shoe. The four edges of the rod were clothed with a weaker light, just like the individual layers of the horse-shoe; this exhibiting the red, green, and blue colors, but otherwise issuing steadily and without motion. It did not present any decrease along its whole extent, and neither edges nor indifferent points could be recognised, as was the case in the horse-shoe.

Fig. 4.



11. Placing the magnetic bar in the meridian or in the magnetic parallel, with the poles directed forward or backward or in the direction of the dip, did not appear to exert any important influence in the shape or direction of the flames, the terrestrial magnetism not being strong enough to effect any considerable opposing action.

12. I now took an electro-dynamic apparatus, on the one hand to make an electro-magnet before her

eyes, on the other to bring to observation the action which this and a common steel magnet would produce upon one another in reference to the luminous phenomena. It consisted of a horse-shoe magnet with the poles widely separated, between which a horizontal coiled electro magnet could be made to rotate. The magnet itself, the poles of which were directed upwards, had legs of square section measuring about three-fourths of an inch on a side. In a dim light it exhibited a condition essentially similar in all respects to that which the large horse-shoe magnet had presented; at the four solid angles of the polar extremities obliquely ascending flames, but in the middle of them, issuing from the centre of the plane of the base, a longer, erect, ascending flame. But this latter was not a dense fiery mass here, for it had assumed the shape of a thin, straight, and vertically erected needle; a modification of the condition which might depend on the relative strength of the magnet, on its size, or on other accessory circumstances of its form. It is possible that a very slight excavation, which had been drilled in the two ends of the steel, for the rotation of fine points fitting on to them, may have contributed to this. The luminous appearance was stationary in this form, and, with a slight difference in size, almost exactly the same at both poles. When I caused a current from a single pair of Grove's elements to pass through the stout silk-covered wire coiled around the iron which served for the electro-magnet, this emitted flaming lights from both ends, and exhibited in an instant all the luminous phenomena of a magnetic rod. Nay more; when it was removed out of the voltaic current, and had thus ceased to be a magnet, it continued to emit magnetic light from the poles, and, as regards luminosity, like the Ritter's pile, went on acting after the removal of the cause. (I shall return to the reason and explanation of this phenomenon in one of the succeeding treatises). *Consequently, in the eyes of a sensitive person, an electro-magnet exhibits exactly the same behavior in its mission of flaming light, as the common steel magnet.**

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* I had five years ago a beautiful case of somnambulism, in a female, who could in her sleep see the light from the poles of magnets, exactly as in this case; even where the armature was applied, she saw lambent blue flames issuing from between the magnet and the armature, and between the plates of which the magnet was composed. Awake, she saw nothing; but on looking at the magnet a while, she fell asleep, and then saw the light again. If she touched the magnet, instantly a deep sleep and rigidity seized her. When I operated with an electro-magnetic single-coil apparatus, the same phenomena occurred as in the magnet. While the keeper or contact-breaker continued its action, she saw volumes of blue light and cloud emanating from the coil around the bobbin; if the circle were closed, the current still passing, she still saw a subdued light, but the grey cloud as before; and if in this state she touched the coil, instantly she became unconscious and rigid. From this it is manifest, that besides that force which can influence the galvanometer, some other agent powerfully influences the human system; and that certain

13. But the reciprocal action exerted by the two flames upon each other was remarkable. *The flame of the steel magnet was completely turned aside by that of the electro-magnet*, and that as distinctly as the current of a blowpipe directs the flame of a candle. To shorten as much as possible the descriptions, which are tedious to read and at the same time difficult to comprehend, I briefly direct attention to

FIG. 5.

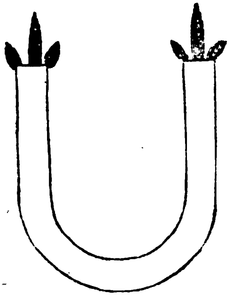


FIG. 6.

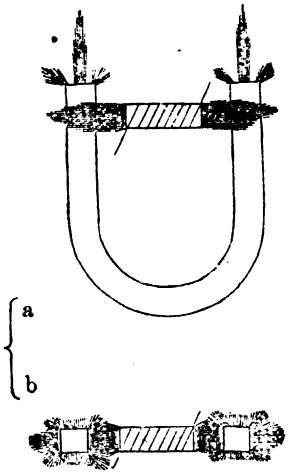


FIG. 7.

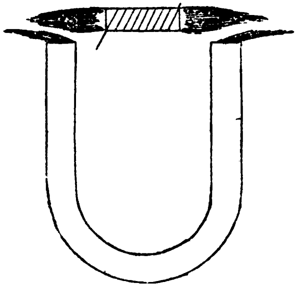
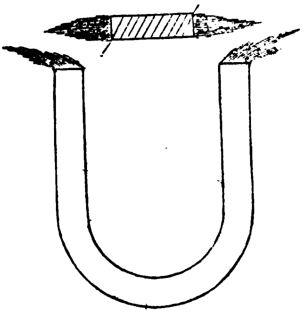
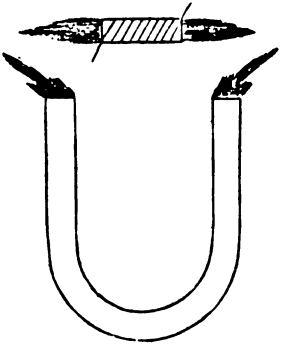


FIG. 8.



individuals in the mesmeric sleep-waking are as good tests of the presence of this agent as any sensitive individuals in an analogous condition of nerves, who may happen to be awake. Since the time above mentioned, several of my somnambules, figures 5, 6, 7, and 9. Fig. 5 represents the steel magnet with its luminosity alone, fig. 6, *a* and *b*, the electro-magnet underneath the poles of the latter, with the outline, fig. 7, beside it, fig. 8, close above it, fig. 9 high over it, and showing the remarkable divergence of the flame of the steel magnet. The question whether this is to be attributed to a difference of strength or to some other cause, is reserved for future investigation.

FIG. 9.



Thus in Miss Reichel we have the fifth and at the same time the clearest testimony for the luminous phenomena at the poles of the magnet.

Lastly, I must mention a Miss Maria Atzmannsdorfer, a girl 26 years old (Golden Lamb, in the suburb Alte Wieden). She is the daughter of a pensioned military surgeon. She has an affection of the head, with spasms and sleep-walking, but walks about the streets looking like a healthy person. I brought her to my house late in the evening, when it was getting very dark, and into a room which I could darken perfectly by closing inside shutters. She was sensitive in a high degree, and saw the magnetic poles flame here in a most lively manner. She described the luminous appearance as still larger than Miss Reichel, from the nine-layered horse-shoe more than twice the height, and gave an exactly similar account of the light, the colors, and the mobility of the flame; like her she saw the whole magnet luminous, and its entire surface clothed with a delicate light. She makes the sixth witness.

14. Let us now briefly compare the different statements: the same nine-layered horse-shoe magnet displayed at its poles, to the eyes of the greatly convalescent—

a. Miss Nowotny, a kind of luminous vapor, surrounded and intermingled with rays of shining, moving, darting, white and sometimes iridescent light, about one half to three quarters of an inch long.

b. Miss Maix, when free from spasms, saw a white flame about a hand's breadth high.

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separated from one another, each ignorant of the purpose of the experiment, have been, at different times, introduced to a room where an electro-dynamic apparatus has been in action, and they have seen an emanation from the coil *exactly* as in the above case. Moreover, in corroboration of the fact noticed by the Baron, each of these persons has repeatedly been put to sleep by touching the helix, at various intervals, from one hour to two hours after the Smee's battery has been removed.

c. Miss Sturmann, a white flame as high as the length of a small hand, with an intermixture of colors.

d. The journeyman glover, a flame a hand's length in height.

e. Miss Maix, in a spasmodic state, a general light, distributed all over the magnet, dazzling her eyes, and issuing largest and strongest from the poles.

f. Miss Reichel, a variously colored, flickering, radiating flame, as large as the whole horse-shoe magnet, therefore 10 inches long; lateral flames out from each layer of the magnet; a general weaker efflux of light along all the edges of the layers inward over the whole horse-shoe.

g. Miss Atzmannsdorfer, the same appearances more strongly marked, and the entire magnet in a delicate glow.

15. From all this it follows, that *those sensitive persons, who are so in a high degree, perceive in the dark, at the poles of powerful magnets, a luminous appearance of a waving, flame-like nature, less or more according to the degree of their diseased sensibility, or the more or less perfect degree of darkness;* that they do indeed differ in their observations as to its size, in consequence of their varying powers of perception, but agree unconditionally in all their general statements; such a luminous appearance of considerable magnitude, of which healthy persons see nothing, does therefore actually exist on magnets. Since, with the exception of an acquaintance between Miss Maix and Miss Reichel, none of the witnesses had any communication with each other, or did even know one another, but lived leagues apart, and in my innumerable experiments never contradicted one another, much less themselves; and since they never stated anything opposed to the fixed laws of electricity and magnetism; lastly, conscious of the precaution and accuracy of my own method of investigation,—I feel no hesitation in expressing the conviction I have arrived at,—that I regard the reality of the perception, by persons of exalted sensibility, of luminous phenomena at the magnetic poles, as incontestible, and as an ascertained and settled fact of science; so far, that is, as an individual observer is in a position to complete it. I am certain that we shall not have to wait long for its confirmation from other quarters. The sensitive are not indeed so numerous in small towns, that they may be found almost everywhere, if sought; but in large cities they are far from rare, and I do not consider it a difficult task to find hundreds at once, if requisite, in a place like Vienna. My statements may therefore be readily tested in Berlin, Hamburgh, or Paris.

16. We will now turn to some of the properties of the magnectic light. That it is invisible to healthy eyes, is not in itself verv won-

derful. When we consider the difference between sun-light and candle-light, the former of which Wollaston found 5560, Leslie even 12,000 times stronger than the latter; when we see how very weak is the luminosity of alcohol, wood-spirit, carbonic-oxide gas, pure hydrogen, and other combustibles, the flames of which are not only wholly invisible in strong sun-light, but become to a certain extent imperceptible in strong reflected daylight, we are aware already of such extreme differences between the luminosities of different flames, that the step to the complete invisibility to our eyes is no longer a great one, and hence the possibility as well as the comprehensibility lies tolerably near. It therefore cannot be regarded as strange, that other lights exist, which fall beneath our powers of vision, and that a luminosity pervades magnets, which, from its weakness, we are usually unable to see.

17. To convince myself, where possible, whether it was actually light then, and not some different kind of appearance, that was perceived by the sensitive persons, I wished to make an experiment with the daguerreotype, and to see if an impression could be produced upon the iodized silver plate. To carry out this experiment, I invited my obliging friend, M. Karl Schuh, a private teacher of physics in Vienna, known by his improvements in the gas-microscope and his skill in daguerreotyping. He shut up an iodized plate, in front of which an open magnet was placed, in a dark box, and at the same time deposited another plate in another dark case, without a magnet. After some hours he found the former, when it had been treated with mercurial vapor, affected by light, the other not; but the distinction was not very strong. In order to make it perfectly clear, he took the magnet, turned towards an iodized plate, with extreme precautions for keeping out every trace of light during the manipulation, of which I was witness, and placed it in a case in a thick bed, and left it there sixty-four hours. Taken out in darkness and exposed to mercurial vapor, the plate now exhibited the full effect of the light which it had received, over the entire surface. It was clear from this, that unless other causes are capable of affecting the photographic plate after considerable time, it, in fact, *must be light, real, though weak and acting but slowly, which issues from the magnet.*

18. I made another *experiment, with a similar view, with a large burning glass.* The lens was about eight inches across, and had a focal distance of about twelve inches for a candle standing about five feet behind it. In a completely darkened room, I brought the magnet, of which the flame was ten inches long, about twenty-five inches behind the lens, and directed it against the wall, calling Miss Reichel's attention to it. The clever mechanist of this city, Mr. Ekling, was

present. We removed the lens gradually four feet six inches from the wall, during which the observer saw the picture of the light continually diminish in size, and first at that distance contract to about one-eighth of an inch. But in spite of this, no one present was able to perceive a trace of the light, even under this considerable concentration. Yet it furnished us with a sure means of testing the accuracy of the observer in a variety of ways. Among others, she laid her finger on the spot where she saw the focal point; I followed her, and, by feeling in the dark, placed mine upon it. Mr. Ekling, who held the lens, now altered its direction a little, without saying in what way. The position of the focus on the wall was thus of course altered in the same direction. The observer immediately gave another, which I traced out with my finger, and then made Mr. Ekling state in what direction he had diverted the axis. Whether he said to the right, downward or upward, my finger was in every case already on the right, below or above. The exactitude and genuineness of the observation was consequently beyond all doubt. She described the color of the focal point as red; and she also said that the whole of the large glass lens was illumined red by the magnet.

19. *The magnetic light emitted no heat;* at least none appreciable by our most delicate instruments. Directed on to a Nobili's thermoscope, I could not detect any movement of the astatic needle of the differential galvanometer, even after a lengthened trial.

20. It was very desirable to obtain some more intimate knowledge as to the substantiality of the flame, light, or whatever we may please to call it, waving over the magnetic poles. Since it did not issue in a radiant form from its source, but in a flickering shape, forming all sorts of curved and changing lines, it could not well consist of a simple and pure emission of light. In fact, when I turned the poles of the magnet downward, it flowed downward in the identical shape in which it flowed upward when I reversed them, and in each direction sideways as I held them to either side. This testifies strongly to its more than probable imponderability, but proves nothing positive as to its nature. But the answer I obtained to the question, how the magnetic flame behaved when blown upon, seemed to me more important in this respect. The observer said that it flared divergently to the side like any other flame. When a solid is brought too near, the points curl round it: when in the last experiments, also, the large glass lens had been brought too near the open magnet, the flames had applied themselves upon the glass exactly in the same manner as happens when another glass is placed in the flame of a candle to blacken it; when the hand was placed on the magnet, the flames passed between the fingers and out behind the

hand, &c. It follows from this, that the *magnetic flame* is *evidently* either itself *something wholly material*, or has such for a substratum; further, that the *magnetic light is something different from it*, and the *magnetic flame is a compound*, in which some kind of materiality is united with the immaterial essence of the light.* The

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* In a logical work, the meaning of such words as material and immaterial should be strictly defined. The question relates not here to Theology, but to Natural Science. Great confusion of ideas must inevitably result from misapprehension of the accurate import of terms. If I understand the adjective material, it relates to *matter—something.* On the other hand, immaterial relates to *immatter—nothing.* Divisibility is infinite. The attenuation of any substance in space is bounded only by the opposition offered to its expansion by the pressure of other matter; otherwise its expansibility would be infinite. It is impossible to conceive of its annihilation—of its being reduced to *nothing.* Without clear ideas, logic is nothing—philosophy is nothing—reason is nothing—truth is nothing. Their provinces are in entity. It is absurd to speak of reasoning upon *nothing.* We cannot conceive of nothing. Our faculties have no relations to *nothing.* Being in themselves something, we can have no faith in nothing. Move for an instant from physics to theology. It is the atheist who believes in *nothing.* The believer in a God, clearer in his logic, confessing, in great humility, his perfect and complete inability to grasp the idea of nothing, can never measure more than the attributes of an all-wise, all-just, all-holy, and all-powerful *Being;* still, cannot believe that being non-existent. He *talks* perhaps of that Being being immaterial. He does not for one moment mean constituted of *nothing!* He would be wiser to avoid the use of terms which have no meaning. . . . Real humility, which characterizes real philosophy, leads him to say—"I do not know, but in future I will not talk nonsense about immaterialism. I will not get angry, I will not dispute about what no imagination can conceive. A being must be something, although I may be quite ignorant of the nature of that thing." It is highly important that, in all considerations on those agencies which are sometimes designated as *imponderable* forms of matter, we should not use such terms as *immaterial.* The term can be used only when there is an absence of a clear idea, or a willingness to envelop the mind in hazy cloudy clothing.

It is a mistake to suppose that accurate definition is necessary only in metaphysics. All the phenomena relating to the subject of light may one day be proved to belong to the science of psychology; and the researches now presented to public notice may indeed be regarded as the commencement of very numerous investigations hereafter by men of science, which must establish the relations of light to the phenomena of the human mind. It is silly and idle to oppose to the progress of clear ideas the confused nonsense which pervades the brains of men who cannot help hating all new truths. Those who are really *honest* and *sincere* in their religious faith, need never fear the advance of science. A wise and just God, permitting the developments of truth, decrees that man cannot alter the laws which regulate Nature in her operations. The repulsive agencies of his brain may malignantly oppose the revelations of science, which are the revelations of God's will to man given out at progressively advancing *periods* of that time which is a fragment of Eternity; but they cannot overwhelm the truth, and are able to stay its progress only as the midge intercepts the progress of the sun's light for a moment. To our limited ken, all Nature's truths are material. Mathematics have enabled wondrous philosophers to calculate the sensitive person actually sees the magnetic flame curve round the glass lens, while the light itself passes through, and its rays may be

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speed at which light travels, and the admirable observations in paragraph 16 of the text are sufficient to prove that the materiality of all light, when man's ken shall be enlarged by science, may come to be easily established. I have known at least fifty persons who have seen a grey silvery, or a blue light emanating from my hand and fingers, when they have been wide awake. I have known a great many persons who having been put into mesmeric sleep have declared that they have seen blue light issuing in copious streams from my eyes, when I have concentrated my thoughts in the acts of volition or study. This is so common, that as the investigations into mesmerism proceed, I know there must be thousands of corroborations of the fact, instead of hundreds, as at present. Will any one venture to say that a force having relation to such a light is not a material power? The light proceeds from the brain of a person willing, and impinges on a sleeper—sent to sleep by a magnet—or by a crystal. The light is sent forth by the will of that person, and becomes a motive power, for the recipient sleeper moves and obeys the mandate received through the luminous agency. I have repeatedly performed an experiment under these circumstances, and the results have been as above stated. But though I have often willed persons awake as well as sleep-wakers, and even magnetic and crystallic-sleepers, to do my silent bidding, proving that the light from my brain is a motive power, I regard some other experiments on rare subjects to be still more conclusive as to the material agency of the light which emanates from the human brain. I have caused it to travel 72 miles, producing immediate effects. I have witnesses who can testify that I have repeatedly willed an individual to come to me when at the distance of nearly two miles. I have witnesses who can testify that a patient for some months required the force of the light emanating from my brain by the exertion of the will, to enable her to sleep at all, when she was at the distance of nearly two miles from me.

Hundreds of persons have seen an individual made insensible and rigid by my imagining a circle round her. In her delirium, which made her muscles enormously powerful, she would occasionally master several persons. My will, impinging its light upon her, rendered her not only tractable for a time, but set her fast, for hours, in a deep sleep and rigid spasm. If I imagined a bar on the carpet, she could indicate with accuracy the position and limits of that bar. She described it as a bar of blue light on the carpet; and if she were desired to get up and pass over it, she became insensible, and fell on the floor like any inanimate object. Sometimes I have placed this bar of light across the threshold of a door, and it has been impossible for her to pass over it. The sight of the blue bar of light, placed by an effort of my will, even after many repetitions of the experiment, made her fall down insensible; and she has remained insensible to all external impressions, like a person dead asleep on the floor, until I have willed the bar to disappear. Hundreds of persons have seen me perform this experiment. On one occasion I left the bar for one hour and a half, and she remained quite unconscious, getting up instantly when I willed its disappearance. Though not a common, this has not been a solitary case illustrative of such a striking fact. Charpignon (Etudes Phys. sur le Magn. Anim. Paris, 1843) has proposed physical tests to establish the existence of the mesmeric fluid. One of them consisted in collecting the fluid from the ends of the fingers into a glass tumbler, and then getting patients to inhale the air collected in that glass vessel. This put the individuals to sleep. Several persons have seen while awake the blue light collected in a focus. Miss Nowotny and Miss Sturmann both assured me that the light spread a brightness around it, and illuminated neighboring objects; and Miss Reichel marked the exact distance to which the visible light of the magnetic flame spread over the table on which it lay; I measured this, and found it to extend to about nineteen inches in diameter. Whether that which issues from the magnet in the form of flame is really a substantial emission, or only indicates an alteration of condition which the magnet produces in the surrounding air, or according to the newer theories; in the ether, which then in further progress becomes associated with an evolution of light, are questions to solve which many more things, among others the slow spontaneous loss of power of the steel magnet, must be placed in the balance, and they must remain as subjects for further research. For the present, only this much is established;—that the magnetic flame, turning aside before mechanical obstacles, is not identical with the independent, simultaneously issuing magnetic light, which possesses a higher radiant nature.

21. And now I return to the introductory consideration of § 2. The first practical use to be made of these observations would be an endeavor to apply them to the elucidation of the aurora borealis. We are in possession of the valuable explanations given by Sir Humphry Davy, who applied the influence of the magnet on the electrical current in rarified air, to the aurora, and endeavored to make out the probability that this phenomenon was produced by a current of this kind on the outermost limits of the atmosphere. But since, through the recent polar expeditions, it has been found how deeply this frequently descends in the atmosphere, Davy's ingenious comparison has lost much of its certainty; the rarified space, the ground on which he based it, has disappeared, and with it the diffusion of the free electricity, which, derived from our thunder-storms, he claimed for the aurora. The certainty which we possess that the aurora is only

proceeding from my fingers, and collecting in the glass. I have directed their attention to other objects, so that they could not be aware of my resuming hold of the glass I had left, and have been unawares put to sleep by my pouring the fluid on the back of their necks. On several occasions lately, I have sat in one room willing the mesmeric light into a wide-mouthed phial of a pint capacity, and have taken it into another room, where, pouring the substance on a patient's head, she has instantly fallen asleep. These experiments, performed with every precaution to avoid sources of fallacy, can succeed only in cases of most extreme susceptibility. Repeated occurrences of these facts, and, as they are easily reproduced, we shall have accounts of many of them, will establish the conclusion that *a force which is a material agent, attended by or constituting a colored light, emanates from the brain of man, when he thinks—that his will can direct its impingement—and that it is a motive power.*

formed under the influence of the magnetic poles of the earth, the total absence of any direct phenomena of light on the magnets, which we have hitherto assumed; the facts now gained, that although invisible to common eyes, colored, especially white, yellow, and red emissions of light do issue from magnets, certainly must lead us to surmise that the aurora may be either actually the magnetism itself issuing from the polar regions, or else a direct effect of it. It is known that the aurora, when it appears, affects and disturbs the magnetic needles of whole countries, as does the magnetic flame, or the magnet producing it, at a certain distance: lastly, it is, in fact, only the emanation from the magnet, and not the magnet itself, which produces the movements at a distance; and thus, therefore, the deflecting action of the aurora upon the needle completely agrees with those of the magnet. Finally, if we compare the special phenomena in the appearance of the magnetic light and the magnetic flame, with those of the aurora, the probability of such an assumption evidently increases. The aurora is known as a white arc, according to others as a white vapory or cloud-like mass on the polar horizon, from which shoot out towards the equator flickering, brush-like, wandering rays, the lines of which have indeed a principal direction, but are not parallel to each other, nor straight, but appear curved slightly in various ways, and sometime scintillate. Their color changes from the white of the arc to bluish, emerald green, yellow, and above all, red, which light they then spread over whole zones. The same mobility of emitted rays, the same flickering flame running in curved lines, the same brilliant play of color, the same reddening of illuminated objects, we find described in exactly the same way by the observers of the magnetic phenomena. The observations, it is true, do not agree perfectly with each other, but they coincide in all important points. The distinctions between them depend chiefly on the different size of the flaming objects, which is of minor importance; it is explicable by the different degrees of sensibility to the magnetic light of different observers. In particular we see two different pictures of light appear in the eyes of Miss Maix, according as she was either in a quiet condition or in an attack of spasms: in the former case, a flame of only a hand's breadth rested on the poles; in the latter, not only had this much increased and become more brilliant, but the entire large horse-shoe was covered with gushes of light. In the same way we find with Miss Nowotny, that the apparent size of the magnetic light, in her observation, kept pace with her convalescence, and that the picture of it appeared to become smaller, from period to period, in the same proportion as her disease diminished, till at last it became wholly imperceptible to her senses. At one particular period she recognised a kind of luminous vapor immediately over the steel, which the far more sensitive Miss Reichel never saw; from this cloud of vapor she saw the tufts of light issue in the same way as the latter perceived the tufts of light from the corners of weaker magnets. This vaporous cloud, immediately upon the steel, resembled in a high degree the polar luminous arc of the aurora; and if Miss Reichel, as she stated, saw nothing of it, the reason certainly is, that in her sight, which perceived the far more flickering light and the flames ascending from the shorter layers of the magnet, the vaporous cloud was covered or eclipsed by these so that she could not possibly see them. It might be expected that, with the progress of her recovery, a period would ensue in which the flames of the sides of the layers would disappear, and then the vaporous cloud would be free to her eyes, and would be seen as well by her as by Miss Nowotny.

It is this calm, bright, cloud-like appearance, however, which brings the resemblance to northern light to such a high degree of agreement, that one is involuntarily led to the acknowledgment of the complete identity of the aurora and the magnetic light. But I must not be misapprehended: I do not wish to say that I regard the identity of the two phenomena as proved; for between lights visible and invisible to healthy eyes lies a chasm which is not yet filled up, and cannot even be filled up by the hypothesis of a different intensity of the two phenomena: but I believe this much to be certain, and that I may venture to express it, that an astonishing analogy exists between the two; so great, that the *identity of the magnetic flame and the aurora* rises unmistakeably to a high degree of probability.

22. RETROSPECT.

a. A strong magnet exercises a peculiar action upon the senses of many healthy and sick persons; it is an agent upon the vital force.

b. Those who manifest this sensibility in a high degree frequently exhibit a great exaltation of the acuteness of the senses, and are then in a condition to perceive light and flame-like appearances upon the magnet. The strength and distinctness of this perception increases with the sensibility of the observer and the obscurity of the place.

c. The pole −M gives the larger, the +M the smaller flame, in the northern latitude of Vienna. Its form and color change according as the magnet is open or closed,—a magnet made by touch, or an electro-magnet,—free, or under the influence of other magnets.

d. Positive and negative flames display no tendency to unite.

e. The flame may be mechanically diverted in various directions, just like the flame of a fire.

f. It emits a light which is red, that acts upon the daguerreotype, and may be concentrated by a glass lens, but is without perceptible heat.

g. Magnetic flames and their light exhibit such complete resemblance to the aurora, that I believe myself compelled to consider the two as identical.

SECOND TREATISE.

CRYSTALS.

23. PREVIOUSLY to my visits, Miss Nowotny's physician had repeated some of the observations of the older physicians in cataleptic cases, in particular those which Dr. Petetin, at Lyons, in 1788, as well as other persons, had investigated and made known;—that when a powerful magnet was placed upon the hand, it adhered to it in the same way as a piece of iron to the magnet; moreover, that water through which the magnet had been passed a few times, was accurately distinguished by the patients from common water. The latter was first observed and made known by Mesmer, often enough ridiculed, and as often re-asserted. We shall see in the course of the present investigation how much of it is found true, and how much false, by the test of physics. The adhesion* of a living member to a magnet is a fact totally unknown both in physic and physiology, and few persons have satisfied themselves on the point by inspection; it is necessary, therefore, to examine and elucidate it in some measure

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* I have seen two persons whose hands, when the individuals have been awake, could not be kept away from the poles of a powerful horse-shoe magnet presented to them at a distance of six feet. The attractive power of the magnet always induced these ladies to move the head and to incline the body forward. But I have witnessed the phenomenon of the attraction of the hands to a magnet in more than twenty cases of individuals in a condition of sleep-waking. A boy, aged 14, who occasionally came to my house in Wimpole Street, used to rush forward from a distance of six feet to a magnet with a ten pounds sustaining power; if I took off the armature while I sat opposite to him, the poles being directed towards him, he would fall asleep on his way to the magnet, and remain unconscious while his hand adhered to it. I must continue to regard the sleep-waking state as no obstacle to the conclusions arrived at by the Baron, and I look upon the facts in mesmerism as corroborative of the establishment of truths erroneously imagined to be arrived at in a condition of system non-mesmeric. The simple act of falling asleep may establish the existence of a tonic state of nerves, but that tonic state of nerves is not incompatible with acuteness of perception in perceptive organs—with acuteness of apprehension in intellectual organs—with extreme delicacy of conviction, refinement, and grace in the moral organs; and of great increase of sensibility and force in the organs of passion and desire. It is phrenology that must be studied to enlighten us on the relations of physics to the phenomena of vitality.

in this place. When the sick Miss Nowotny lay unconscious and motionless in a cataleptic condition, but free from spasms, and a horseshoe magnet, capable of sustaining some 22 lbs., was brought near her hand, this adhered to it in such a manner that when the magnet was raised, or moved sideways, backward, or in any desired position, the hand remained constantly attached to it, as if it had been a piece of iron cleaving to it. The patient remained perfectly unconscious all the while; but the attraction was so strong, that when the magnet was drawn down in the direction of the feet, beyond the reach of the patient's arm, she not only did not leave it, but, in an unconscious state, rose up in the bed and followed the magnet with her hand as long as it was at all within her reach: thus it looked as if the patient had been grasped by the hand, and her body thus been drawn toward her feet. Finally, when the magnet was removed beyond its distance of attraction, she was indeed compelled to leave it, but then remained unalterable and immoveable in the position in which she had been placed, according to the well-known manner of cataleptic patients. This I saw daily, between six and eight o'clock in the evening, when the patient had her fits; and eight or ten persons, physicians, physicists, chemists, and friends of science, were usually witnesses of it, to name whom can be of no essential use to me.

When I visited the girl at other times of the day, in the morning for instance, I found that the phenomena were still the same at the time of her best and clearest consciousness. Her hand followed the magnet which I placed on it, exactly in the same way as when she was in the unconscious cataleptic condition. The account of the matter which I obtained from her added little to the explication of this physical singularity; she described her sensation as an irresistible attraction, which she felt compelled to follow unconditionally and involuntarily, and which she was obliged to obey even against her will. It was an agreeable sensation, as if connected with a cool gentle wind, issuing from the magnet on to the hand, which seemed to be attached to it as by a thousand fine threads, and to be drawn along by it. In other respects she knew of nothing at all like in life, and the whole was a peculiar, indescribable sensation, in which lay a refreshing, infinite pleasure, when the magnet was of the right size and not too strong.*

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* Since the thing appeared far too strange, and stood too completely in contradiction to the known laws and powers of the magnet, for me to see my way clearly, I confess that, at first, doubts arose in my mind whether all was quite right here, and whether some intentional deception was not going on, however much this might stand in opposition to the visible manifest honesty of all around, and the respectability of the patient. I therefore took various measures

I subsequently had opportunity to observe exactly the same phenomenon in Miss Reichel. The complaint was different here, but

of precaution,—bound up the eyes of the patient in the cataleptic state, operated in variously modified ways with the magnet, &c.; but the reactions were always the same. It will be necessary to mention here some of the tests to which I subjected the patient. Among others, I concerted with a friend, that while I stood beside the bed and observed the patient, he should stand at the other side of the stone wall against which the bed was placed, and at an appointed sign should alternately open and close with the armature a strong magnet capable of sustaining 90 lbs., keeping it directed toward the patient when open. It was easy to find the place of her head on the other side of the wall in the next room. Scarcely was the armature removed when the patient became restless, and complained that a magnet must be open somewhere, desiring that some one would look, and relieve her from the pain; for large magnets always caused her great uneasiness from over-excitement, while smaller ones were pleasantly cooling. The armature was replaced without her knowledge, and she became quiet again. When this was secretly repeated she became perplexed, and could not conceive the cause of this changeable uneasiness which seized her and left her again, just as if a magnet had been turned towards her. The magnet had, therefore, acted through a stone wall without the patient being aware of its vicinity, exactly in the same way as it did when lying open before her, in correspondence with the known laws of magnetism, which penetrates irresistibly through all bodies. Lastly, the riddle was explained to her, and the experiment repeated with her conscious participation; every time the large magnet was opened it produced the same varying unnatural redness in her countenance as I had seen appear and disappear during the secret treatment. Another exceedingly well selected test was undertaken by M. Baumgartner, well known in his former capacity of Professor of Physics, at a visit for his own satisfaction. When the phenomena with the magnet had been exhibited to him, and their strange effects upon the patient repeated one after another before his eyes, he took from his pocket a horse-shoe magnet of his own, which he told the bystanders, in the presence of the patient, was the most remarkable of all the magnets in his collection of apparatus, and that which had always proved itself the strongest; he was desirous, therefore, of knowing the strength of the action it would exercise upon the patient. To our astonishment, however, Miss Nowotny declared that she could not confirm this; on the contrary, she not only found it much weaker than any, even than the weakest of the magnets present, but it seemed to her almost without influence; she did not smell it, she did not taste it, it did not make her hot, and it did not attract her hand at all. M. Baumgartner laughed at our astonishment, and now told us that the horse-shoe, which was indeed his best magnet, had been deprived of its magnetism before he left home by friction in the reverse direction, and, therefore, its power had been reduced almost to nothing; that it, therefore, was little else than a mere plain piece of iron; in fact, it no longer evinced any attraction for its armature.* M. Baumgartner had desired to assure himself of the truth of all that took place here, and thus furnished us all with a new warranty of it. After such tests, of which I could mention others similar in their nature, I hope I shall not be required to give new securities for the truth of these things, the accuracy of which will, moreover, be sufficiently tested by itself in the course of that which I am here endeavoring to explain.—*Author's Note.*

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* Among several other remarkable instances in my own experience corroborating this fact, I may notice a striking case of a lady who felt very unpleasant effects when a powerful mag-

also connected with periodical cataleptic fits, and both in these and in the awake condition her hand followed a strong magnet, exactly in the way I have described it in Miss Nowotny. Professor Lippich reported the same to me of a stage of the disease of Miss Sturmann, which I was prevented from examining myself; and I have every reason to place unconditional trust in the accuracy of the statement. These different cases, compared with those of a similar kind which Petetin, Rick, and others furnish from past times, leave no doubt of the correctness of the fact, *that in certain diseases, especially those in which catalepsy exists, a distinct attraction occurs between the human hand and strong magnets.**

I also made an experiment on the feet of Miss Nowotny; there also I found a like attraction, but far weaker; but no other place, sensitive in this way, existed in any part of the body.

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* The Baron is most correct in this conclusion,—that in constitutions of a tendency to catalepsy, "*a distinct attraction occurs between the human hand and a magnet;*" and he enlarges the proposition by the words, "*in certain diseases.*" Now, what are these diseases? All affections of the nervous system which fall under a great class of those exhibiting proclivity to clonic spasms, may be considered as opposed to another of those evincing a tendency to tonic spasms. In the one set there is an attraction between the particles of nerve matter, and in the other there is a repulsion between those particles. In the opposite conditions of brain and nerves which obtain in sleep and in vigilance, we have illustrations of this idea. Constitutions vary according to degrees of tone and clone, and there are thousands of *grades* of these opposite states. If, in vigilance, tone gives a character to the frame, and is habitually carried to its extreme point short of sleep, with rigid spasm, the individual is in perfect health, and is in a condition bordering on that which is characterized by a want of sensibility to magnetic impressions. Remark the opposite extreme; hysteria,—fragile frame, with debility and very delicate susceptibility to impressions. Inflict the poison of hydrophobia on the tonic individual, and the extreme clonic spasms are not long before they become evident. A reversal of polarities ensues, which makes the person more extremely susceptible than the most fragile hysterical female. The brain and nerves in tone are compact and tense; in clone, loose and wanting in firmness. In the course of a long mesmeric treatment, patients exhibit in some cases various phases in degrees of sensibility to impressions. The organs of the five senses may become more acute, and their powers exalted. The intellectual, the moral, or the lower animal nervous functions, according to the individual peculiarity of fabric, may be more strikingly manifested. A time arrives when tone assumes the mastery. Deep sleep, the best test of the progress towards tonic health, balances the relations between nerve and blood, and the patient is restored to a state of mind and body in which neither mesmeric manipulations nor powerful magnets have much more than the slightest influence in producing attraction or repulsion. The diseases, then, in which the magnet influences the hand by attraction towards it, are those in which a proclivity to clone preponderates, and in which a due course of mesmerism or magnets have not perfectly conquered this disposition.

net, in my possession, happened to be in the room where she was present. It was accidentally upon my table one day that she came in, and seeing it she remarked that her constitution must have undergone a change, since she perceived that without inconvenience she could remain in the room with that magnet: in fact it had been deprived of its magnetism.

24. The first and most immediate question that arose now was, whether the attraction which the magnet exercised upon the patient was reciprocal, or whether it was exerted by it upon bodies capable of participating in the diffusion of magnetism, and, like iron, temporarily converted into magnets by the approximation of a magnetic body; in other words, whether, through her diseased condition, magnetism, and, with this, magnetic attraction, resided in herself? To decide this I took some iron filings and brought the patient's finger over them; they did not adhere in the slightest degree, even when she was in contact with the magnet, and might thus have been more strongly influenced than she might have been naturally. A suspended magnetic needle which I brought to her, and which I bade her hold her finger close to at both poles, and in variously modified alternating ways, was not caused to diverge or oscillate in the least. Another experiment in reference to this point was made at the desire and in the presence of M. Baumgartner. When the hand, and with it the whole arm, were lifted up by the magnet, it seemed to many that the horse-shoe became as much heavier as the weight of the attached burden, the arm, amounted to. I could not find this myself, but many persons believed that they felt it distinctly. The horse-shoe was therefore attached to the beam of a pair of scales, and its weight balanced by a counterpoise. After the patient's hand had been spread out flat, with the back on a firm support, I held it fast down upon this by the tips of the fingers, and the freely suspended magnet was brought near to it: the hand strove to move toward this, and I was obliged to exert some force to keep it back; but the index of the balance did not stir in the least, even when the magnet almost touched the fingers, and then strove so convulsively to contract, that I had much trouble to retain them in their flat position.

While I was busied with these investigations, the known statement of Thilorier, that he had magnetised steel by induction from nervous patients, appeared in the journals: whether the induction here depended solely or only in part upon the disease, I must leave unsettled: the result in Vienna was, that I soon received news from their physician that both Miss Reichel and Miss Maix converted every steel needle into a magnet, by holding it in the hand for some time. I went to see the patients, who assured me of the correctness of the matter, and showed me knitting needles which supported common sewing needles. I made the experiment with them myself; procured knitting needles which were not at all magnetic, removed all magnets from the vicinity of the patients, and gave them the needles. At my desire they held them in the hand, first the same length of time, then twice as long as in the previous experiments, in which their medical attendant stated he had produced magnets with them, but the needles were not magnetic now, and all endeavor to make them so was in vain. Doubtless it had been neglected before to examine the condition of the needles previously to the experiment, for among a dozen knitting needles always half are more or less magnetic. Lastly, I was assured that Miss Sturmann was so magnetic that she caused the magnetic needle to diverge from twenty to thirty degrees. I was invited to a trial by Professor Lippich, and really saw a freely suspended needle considerably deflected. As the needle was not sufficiently secured from currents of air, I undertook the experiment next day, with the precaution of placing the needle in a vessel which was covered by a glass plate at the top, so that we could see all that took place. At the side I had made a round hole just large enough to admit a finger. By this means the patient could bring her finger quite close to the needle without setting the air in motion, while the breath of those standing round could no longer exert any influence on the experiment. When the finger was introduced, it appeared this time that some attraction occurred. I examined the tip of the finger, and as it seemed rather moist, I rubbed it over with flour for another trial: then all attraction for the magnet was at once at an end; the needle remained motionless. It was evident that in the former case the very mobile needle had adhered to the finger from the presence of slight perspiration, and when the slight stickiness of this was removed by the flour, all attraction ceased directly. It was not of magnetic nature, but an effect of adhesion. Quite superfluously I afterwards introduced Miss Sturmann's finger into the helix of a differential galvanometer: neither when inserted or taken out was any induced current perceptible, and the astatic needle remained immoveable.

25. From the preceding it follows, that the attraction exercised by the magnet upon the hands and feet of cataleptic patients is nothing ponderable; *it has no supporting power*, cannot even raise iron filings, and is equally incapable of affecting the magnetic needle and inducing a magnetic current. The arm lifted up in catalepsy therefore supported itself, and its passive *attraction was quite different in its import from that of iron toward the magnet*, or, more accurately, toward magnetically oppositely polarized matter in the sense hitherto received.

It is known well enough that we are not acquainted in physics with any attraction which is not reciprocal. On the other hand, it is equally well known that a person in a state of cataleptic unconsciousness, which cannot be feigned, not only has no free will, but in fact no will at all :* since, therefore, the magnetic mechanical attraction

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* This is the subject which is the keystone of all the objections to the application of magnetism or of mesmerism to the human system. To shew that man is not a free agent is bad enough, but to prove it by physical facts should be atrocious. The instinct of those who have large organs of cunning, acquisitiveness, and self-esteem, is instantly on the alert; and forgetting that they do not wholly belong to the baser animals, they give way to the lower feelings of their nature.

Instinctive feelings operate powerfully upon mankind as well as upon the animals not gifted with the organs of the reasoning faculties, and the condition of the brain of the man who anticipates disagreeable change, or something adverse to his foregone conclusions, is just that which is analogous to the magnetized brain which has no free will. The being of prejudice with his very limited power of understanding is, of necessity, no free agent; he is not more so than the tiger, who, following the law of his organization, flares his eyes with ecstatic delight while he mangles his prey. It is the decree of such that Man is not to know of his brain being influenced by external agencies. With a penalty before him, the risk of disease, or of death, he may be permitted to indulge in the dead-drunkenness of chloroform, of opium, or of brandy, in its many shapes, for then he is not placed in those gradations which excite in his fellow man the reasoning faculties. Sinners have free will, and are accountable beings, even when drunk; but a man rendered fatuous, ecstatic, or unconscious by a magnet, is too evidently a being without a will. There are various degrees of the influence exerted by magnets on the brain. It is not a necessary consequence that unconsciousness should accompany the catalepsy which results from this agency. A man may be quite conscious, and yet be unable to exercise *will:* or the organs of his brain, influenced by a force analogous to the magnetic power, may be placed in a condition such that the individual is unable to act, except at the bidding of another. *Apparently* there are other influences, but a stricter study of the philosophy of this subject will show us that they are *really* what were formerly called magnetic, but which Reichenbach's discoveries will establish as crystallic or mesmeric, operating upon the brain of man, and obliging him to form convictions, to do deeds, that prove him as much a machine without free will as if he had actually been the victim of the Baron's largest magnets. All influences, all impelling forces, acting upon the phrenological organs of man, are motive powers. Do we not in common parlance speak of the influence of *motives?* No one acts without a motive: so that the immediate antecedent motive or force is the necessary impellent to the production of the consequent action. The will of the Jesuit, like that of the snake persuading Eve, is as much an overpowering magnetism as the flames from the light-spreading magnet: they both act by an influence of attraction. The serpentine luring is attractive, like the rattlesnake's, to destruction, to arrieration, and perdition. This magnetic light, a symbol of Baron von Reichenbach's illumination against superstition, attracts to the establishment of health—the parent of many blessings. But in each case the victim is the creature of a necessity. To speak of his free will is an absurdity. He is trained to his actions as much as a vine is trained against a wall to grow in a direction about which it has no choice. The Negro victim to the superstition of Obi is in a magnetic groove, in which he runs his course and dies. Then, is man in all his actions to be considered as a machine obeying the impulses received upon his brain from the thousands of crystallic forces that are playing upon him incessantly? Look at by the magnet is a fact, which is not only established here by sufficient experiments, but may readily be tested and confirmed in every large town, where such patients are never wanting, it acquires, in spite of all its apparent strangeness, a solid, scientific certitude, and imperiously claims further investigation. Not in order to explain it, but to render it provisionally in some degree comprehensible, I venture to refer to all the attractions and repulsions which the vegetative life of animals and plants unceasingly brings to pass, in thousand-fold variety, without our being able at present either to perceive or even to infer a counter attraction. A root penetrates strongly into the hard soil, breaks and bursts powerful mechanical obstacles: we perceive no cause for the counter-attraction or counter-expulsion which so powerfully impels it thereto, and yet it happens. Similar conditions lead the hand of the patient toward the magnet, whether we now comprehend it or not.

26. When, instead of a middle-sized magnet of some 20lb. capacity, we took a strong one capable of bearing 90lb. and placed this on the flat hand of Miss Nowotny, she grasped, both in the conscious and unconscious state, the presented ends of the horse-shoe, and laid hold of it so firmly that it could not be taken away from her without great effort. She herself was unable to loosen her hold. The whole hand was clenched spasmodically, and the cramp knitted the fingers round the magnet, and contracted the whole hand so violently that all voluntary power of motion ceased.*

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him proceeding along a crowded thoroughfare;—is he not receiving from a plane below the axis of the sphere in which his brain may be supposed to be placed, a constant series of varied impressions, acting in the sense of the centrifugal forces, which are repellent and have the tendency to keep him awake and thinking? and his thoughts under such circumstances, are they not without his control forced upon his attention? A carriage goes over a child;—can he help the start of sympathy? He could have helped it, if . . . if he had had other *motives* offered to him, more powerful than those which obliged him to act as he did; but the *impulse* he received had its legitimate consequences. Regard him under the influence of centripetal forces. They are, like the large magnet, attractive. He is so fatigued he cannot keep his eyes open. Does his free will prevent him from sleeping? The attractive forces are too much for him. All resistance is in vain. He yields, and he sleeps.

Will man never learn the principle upon which all real charity depends? Will man always acknowledge that he is truly the victim of the power of surrounding circumstances, and yet constantly act towards his brother man as if he were free to command the events that control him? Glorious Von Reichenbach! the lights that emanate from your magnets, from your crystals, and from your crystalline brain, are destined to aid in liberating your fellow-beings from their irreligious thraldom of superstition.

* This has been witnessed here very frequently, and we consider the patient to be in a deep mesmeric sleep, with the addition of strong spasm. In my paper

27. I have already (§ 2) mentioned the magnetized water which the patient immediately distinguished from common water, when ignorant of what had been done to it. Nothing could be more disagreeable than the reappearance of an apparently so absurd thing, which all physicists and chemists are horrified even to hear of. But in spite of this, I could not refuse to admit what I saw before my eyes as often as I tried it; namely, that the girl always determined, and unfailingly distinguished, a magnetized glass of water from an unmagnetized. The force of facts cannot be combatted by any reasoning; I was compelled to recognise what I was by no means able to comprehend. But when I again met with the same subsequently in Misses Sturmann, Maix, Reichel, Atzmannsdorfer, and others, and saw it in a still stronger degree, I gave up all doubt and opposition to a phenomenon, the actuality of which no longer admitted of contradiction in any reasonable manner.*

28. But the singularity seemed to reach the height of incomprehensibility when it proved that not merely the magnet, but even a simple glass of magnetized water, possessed the power of drawing along the hand of Miss Nowotny. It is true that this occurred in a much weaker degree, but her hand was unmistakeably attracted, both in

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on the Theory of Sleep (see the Zoist, vol. 4, pages 260 to 267, *passim*) I have endeavored to show that however the cerebral tissues may be arranged to produce results analogous to those caused by our artificial electric and magnetic agencies, attractive forces tend to soothe the individual, and, *by degrees*, induce *quietude, somnolence, sleep*, and *the tonic spasm;* while *inquietude, pain and restlessness, wakefulness, full vigilance, delirium tremens, clonic spasms*, result from repulsive forces. To illustrate the facts here stated, cases analogous to those selected by the Baron should be chosen; but the confusion ought not to arise in the mind that the individuals do not exhibit mesmeric phenomena. Brown study, reverie, absence of mind, are slighter degrees of the state exhibited in Miss Nowotny's case, and are to be produced by a magnet in some individuals.

* These admissions are the proofs of the greatness of Von Reichenbach's mind. This man must have a large brain, with well-developed organs of causality, comparison, and conscientiousness. The facts stated in this and the next paragraph have been exhibited in my house hundreds of times. Water has been magnetized with magnets, mesmerized by the fingers, by breathing, by the exertion of the will: over and over again, the tumblers in which these specifically treated quantities of water have been contained have been instantly detected by somnambulists in the lucid state of sleep-waking, who have been in another room when the fluid was charged; and yet most absurd nonsense has been talked by even Fellows of the Royal Society, let alone those of other scientific or learned bodies, as to the impossibility of the phenomenon. "I won't believe it," and "I would not believe it if I saw it," has been a very common mode of expression with these wise leaders of public opinion. It would be a glorious immortality for them to hand their names to posterity, with a proper measure of the circumference of the head of each individual. But Mesmer, Gall, and Reichenbach will be remembered when they are forgotten.

the catalepsy and at every other time, by a magnetized glass of water, in such a manner that a tendency to follow this in every direction made itself evident.

29. Contemplating this, and convinced that so strange a phenomenon could not exist isolated in nature, I was desirous of trying whether the same effect as that of the water might not be brought about by means of some other body; if this proved to be so, I hoped to see cases occur with various modifications, from which some laws might be deduced. With this view, all sorts of minerals, preparations, drugs, and other things, were rubbed with the magnet, and the patient was tried with them in the same way as with the magnetized water; and it actually happened that all reacted at once upon her, more or less, in the same way as the magnetized water: they attracted the patient's hand more strongly or weakly, but in variously modified ways. Some produced spasms throughout the whole body, others only in the arms, others only in the hand, others scarcely caused any effect, although all had been equally strongly magnetized. It was evident, therefore, that some difference lay in the matter itself, and required to be taken into account here.

30. To investigate this, I now tried to bring the same substances into contact with the patient, *without having been previously magnetized, in their natural condition.* To my great surprise, they also acted now upon the patient, wirh a force which very often yielded but little to that which they had exhibited in the magnetized condition. But the action was not always accompanied by a solicitation to follow the object; on the contrary, that other effect (§.5) which had made the patient grasp the magnet convulsively in her hand, presented itself in various gradations of force. The method of experiment which I followed here, consisted in this: I first placed the various bodies in the patient's hand while in the cataleptic state, and observed the effect, then repeated the same when he was in a state of perfect consciousness, out of the catalepsy. By these comparisons, it was made evident that the action was qualitatively the same in both cases, but it showed itself incomparably stronger quantitatively in the catalepsy than out of it. The effect essentially consisted in this: that the various bodies, when placed in the hand of the unconscious patient, either—

a. Determined an actual tonic spasm in the fingers, as the magnet did, and compelled an involuntary clenching of the hand which held the bodies. These again could be divided into such as simultaneously solicited the hand to follow them, and such as no longer visibly produced this effect; or

b. Those which appeared inactive, and left the hand at rest; the former effect presented itself in various degrees of energy. It either ensued suddenly, directly the hand came in contact with the bodies, or it followed gradually, slowly, or rapidly. The fingers began to curl, by degrees were drawn more inward, after some time closed into a clenched hand, and then remained in a state of tonic cramp. This was precisely the effect produced by placing a very weakly magnetic rod in the patient's hand while in the unconscious state of catalepsy.

Comparing the applied bodies one with another, they arranged themselves in this respect, not according to the character of their substance, nor even in the electro chemical series; in fact, the same chemical substances in specimens of different kinds sometimes produced the effect, sometimes did not: for example, calcareous spar, sugar, quartz, &c. First of all I perceived that there was *not a single amorphous body* among those which re-acted so as to make the hand close upon them; and, on the other side, *that all bodies which did so were crystallized.* There were, nevertheless, a good many crystalline bodies without the power. When, now, excluding all amorphous substances, I arranged the whole of the crystalline bodies in two groups, opposing those which showed themselves powerless to those which exerted the magnet-like influence upon the hand, I found upon the former, the inefficient side, all the *confusedly crystallized*—such as loaf sugar, carrara marble, and dolomite; and further, the substances composed of *many oppositely directed groups of crystals;* such as prehnite, wavellite, lumps of sugar of lead, masses of Konigsberg crystallized silver; on the latter, the effective side, all simple, free crystals, and all those where the crystalline masses had parallel principal axes,—such as celestine, many specimens of gypsum, and fibrous red and brown ironstone. For the sake of distinctness, I give here a list of the bodies with which I made the experiments.

I. Inactive bodies.

a. Amorphous:—
Ivory, wood, &c.
Anthracite.
Cannel coal.
Bitumen.
Amber.
Glass of all kinds.
Osmium, rhodium.
Palladium.
Mercury.
Silver, gold in coin.
Copper, brass.
Bar iron.
Zinc, lead, cadmium.
Dense limestone.
Red copper ore, dense.
Potassium, sodium.
Hydrate of potash, dried.
Chromate of iron.
Selenium.
Liver of sulphur (sulphuret of potassium).
Melted sulphur.
Talc, dense.
"Gurhofian."
Magnesite.

Pumice-stone.
Obsidian.
Menilite.
Opal, common.
Fossil wood.
Egyptian jasper.
Quartz, dense with fatty lustre.

b. Crystalline:—
Granular limestone.
Dolomite.
Orpiment.
Wavellite.
Kakoxene.
Loaf sugar.
Native silver from Konigsberg (an irregular mass of crystals).
Speiss-glance ore.
Prehnite.
Natrolite.

II. Active bodies, all crystalline, good, mostly large and splendid, free crystals from the imperial collection at Vienna.

a. Those which compelled the fingers to close up and grasp the object, with scarcely sensible cramp.

Rough Diamond, very small.
Antimony, metallic.
Mesotype.
Witherite.
Tin ore.
Mica.
Corundum.
Ferrocyanide of potassium.
Sugar-candy.
Leucite.
Granite.
Augite.
Hornblende.
Staurolite.
Sulphate of copper.
Graphite, lamellar.
Wolfram.
Bismuth, metallic.
Argentiferous copper-ore.
Rutile.
Lievrite.
"Spargelstein."
Sphene.
Iron pyrites.
Analzim.
Adular.
Felspar.
Boracite.
Celestine.
Topas.
Apatite.
White lead ore.
Crystallized gold, half an inch thick.
Alum.

b. Those which caused the hand to close upon them convulsively, but did not attract it.

Pistacite.
Glance cobalt.*
Zinc-blende.
Iron-glance.
Magnetic iron-ore.
Rock salt.*
Rock crystal.*

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* I am clear that when these experiments are repeated, many modifications of their results will be found according to the degrees of susceptibility in the individuals selected for the experiments. I have found some cases in which glance-cobalt, rock-salt, and rock-crystal, not only caused the hand to close upon them convulsively, but attracted it so powerfully as to produce an appearance of fatuity in the patients who followed the articles in my hand about the room in order to grasp them with avidity. The attraction of these and many other substances which act energetically on certain individuals, induces a desire of possession of the object which amounts to ecstacy. The consummation of desire constituting temporary fatuity . . . Organism.

c. Those which acted so strongly that they caused the hand to clench upon them with violent spasm, and attracted it when brought near.

Meteorite, from Macao.
Quartz crystal, from Fontainebleau.
Calcareous spar.
Arragonite.
Tourmaline, cold as well as warm.
Beryl.
Selenite.
Fluor spar.
Heavy spar.

All these comparisons may be finally concentrated into the facts, that finely granular crystalline carbonate of lime, dense quartz, and loaf sugar, were inactive; but a free crystal of calcareous spar, a prism of rock crystal, or a good crystal of sugar-candy, therefore every perfectly free crystal, when placed in the patient's hand, irresistibly and arbitrarily excited the fingers, attracted them and drew them inward so as to grasp the crystal, and this in some of the cases with the most violent tonic spasms. Consequently, *simple crystals here furnished a peculiar means of detecting a primary force*, which had hitherto been altogether unknown. So far as is at present made out, this property does not belong *to matter, as such, but to its form, and in fact to its condition of aggregation.* Pouillet, in Müller's translation of his "Manual of Physics," p. 167, says expressly, that "it has never yet been observed in ponderable matter, that the form, the arrangement of the molecules, can be the cause of new forces acting at a distance." But this is exactly the case here; the matter must be crystallized, otherwise it does not re-act in this manner.*

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* All crystallized matter is essentially and ultimately composed of globular, spherical, or spheroidal molecules; and by a number of simple experiments which I have performed on some very impressionable cases, I have been led to the conclusion that all gaseous and fluid bodies are susceptible of a submission to those laws which regulate crystalline forms of matter. Reasoning on the Baron Von Reichenbach's facts, and having previously arrived at certain analogous conclusions before I had seen Professor Gregory's abstract of his researches; from reasoning, too, upon the facts in Petetin, upon the facts detailed by Tardy de Montravel, and by De Puységur and Deleuze, and especially on the influence of magnetized or mesmerized water, examples of which influence in the sense indicated by the older writers as well as in that of our author I had seen some hundreds of times, I arranged a number of finger-glasses varying from three to twelve, containing always the same description of fluid, whether it was water or a solution of some salt in water. These I connected together by means of cotton moistened in the contained fluid, and then passed a current of electricity through it. A few minutes of the current from a dozen of Smee's plates ten inches by five, sufficed to give the fluid properties which it had not before possessed to so striking an extent. Plain water treated in this manner was taken from the current into another room, into which were separately introduced one of six, eight, or sometimes ten patients awake. Plain water not electrized was at the same time introduced to the notice of each, separately, of the same individuals. The

32. When I now tested one of these bodies separately, I found that the capability of producing spasms of living organs did not reside in equal degree in all parts of its surface. Points were formed, and the patient readily detected those which possessed the power either very weakly or not at all; others, on the contrary, where it manifested itself in increased strength. It was discovered that every crystal presented especially two such points, in which the force peculiarly resided. And these points lay diametrically opposite to each other in every crystal; *they were the poles of a primary axis of the crystal.* Both acted in the same way, but one always much more strongly than the other, and with the distinction that from one appeared to issue a cool, from the other a softer, gently warm (seeming) current of air.

33. Endeavoring to trace the expressions of this force in various

effects were very remarkable, for the degrees of impressionability of the subjects were clearly brought out; not one was affected by the unelectrized water, and the electrized water produced different degrees of attraction of the hands or of the head in each patient, and each, in different periods of time, varying from half a minute to five minutes, fell into a deep sleep, the fingers being in the fluid. Electrized solutions of four neutral salts—sulphates of magnesia, soda, and potass, and of nitrate potass, in each caused almost immediate deep sleep, while unelectrized solutions were weaker in effect, varying the access of sleep from three or four minutes to twelve, and in two cases there was no sleep at all, although the taste of the salt was perceived in the mouth. I inferred that the electric current had established a polar arrangement of the molecules of these fluids which developed the Baron's new force, since, like mesmerized water, each was easily detected by the impressionable persons, and each was attended with mesmeric consequences.

Some common air not electrized was contained in a bottle, and the stopper being removed, the wide mouth of the bottle was applied to the nape of the neck of a highly susceptible patient. No perceptible effect. Into the same bottle removed into another room, an iode and a cathode were introduced, and the air was electrized. Now the application, as before, of the open mouth of the bottle, was productive of deep sleep and rigid spasm:—both quickly dispelled by the application of unmagnetized iron.

A wooden, a porcelain, and a glass tube were successively used in four cases, selected for their very delicate impressionability, for the following experiment. One extremity of the tube was held close upon the organ of sympathy, without touching it. I blew through the tube, and deep sleep with rigidity immediately supervened. The tube was turned, and the other extremity was held at a little distance from the organ of sympathy. The patient wakened up, the muscles slowly relaxing. The tonic result was more rapid than the clonic. This experiment having been frequently repeated with the same results upon four different individuals, I inferred that the air blown through the tube in one direction had a polarity among its molecules diametrically opposed to the polarity acquired by the molecules of the air passing soon after through the same tube. If any of the tubes were laid down for a few minutes, it became indifferent which end was first used.

directions, I now made the experiment of drawing the stronger pole of a moderate sized crystal which I had at disposal, a rock-crystal two inches thick and eight inches long, a certain distance down along the inside of the hand, in the same way as is customary with the magnet, when it is intended to throw the patient into the usual sleep. It was found *that the effect was exactly the same as that produced by a small magnetic needle, such as is used in a compass*, which I had at hand for comparison. This needle was nearly six inches long, one-eighth of an inch broad, and one twenty-fifth of an inch thick, weighed about one hundred and eighty-five grains, and supported about twice its own weight. When I drew the point of the crystal along downward from the wrist, slowly through the palm of the hand to the tips of the fingers, the patient had the sensation of a pleasant, light, cool breeze directed over her; when I took the little magnetic needle, it produced the same in the like degree. When I reversed the experiment, so that I carried the pass from the middle finger upwards to the wrist, the magnetic needle produced a contrary, luke-warm sensation, evidently disagreeable to the patient;—the point of the crystal produced exactly the same when the reverse pass was made with it in the same way. Another time I brought a crystal three times as large: when drawn downward over the hand, it behaved like a magnetic bar capable of supporting a pound and a quarter of iron; but the reversed pass, up the hand, acted so violently, that the spasmodic condition produced by it ascended along the arm as far as the armpit, continued for several minutes, and by its violence rendered a repetition improper.

34. Furnished with these facts, I repaired to the hospital of our University, with a view to try whether the observations which I had gathered from Miss Nowotny could be repeated on other similar patients, confirmed, and brought to some degree of generality. Under the kind permission of Dr. Lippich I again directed my attention to Miss Angelica Sturmann. I made the pass over her hand with the apex of a rock crystal six inches long and two inches thick. The effect ensued immediately, the patient felt the warm and cool sensations very distinctly when the passes were made over the hand. When I applied the other pole of the crystal in the same manner, the sensations were just of the same kind, but weaker and reversed; these two patients therefore agreed with each other. The action on the sick Miss Sturmann was so strong that it affected the whole arm as far as the shoulder, the warm and cold sensations being prolonged all the way up. When I subsequently applied a crystal three times as large, this acted so powerfully upon the hand, immediately

upon the first pass, that her color came and went suddenly, so that I did not venture upon a second experiment with it here.

I now tried the pass from the head down over the face; she described everything here exactly in the same way, and the sensation was especially perceived along the temples. Counter-experiments with the above-mentioned magnetic needle produced exactly similar effects, only the needle was here evidently felt more weakly than the rock crystal. Finally, I afterwards made the same experiments on Miss Maix. On this very sensitive patient, who, however, always remained fully conscious, the crystals acted not merely on the line of the pass, but over a broad strip up and down the hand, which action ascended all up the arm. Two months later, I tried Miss Reichel. This, to outward appearance, healthy and strong girl, possessed such sensibility to the crystal pole, that she perceived its approach even at considerable distances. Like her predecessors, she found the pass downward cool, upward warm, with the northward pole (— M); with the southward (+ M), on the contrary, that downward warm, that upward cool. Lastly, I became acquainted with Miss Maria Atzmannsdorfer, and found in her a *sensitive* subject,* who felt the pass of the crystals, strongest of all. Even little crystals, of fluor spar, selenite, sulphuret of iron, &c., an inch or so long, produced a sensation of cold when passed down the hand: with rather thin acicular crystals, I could, so to speak, describe lines upon the hand; but the pass upward produced warmth of the hand, and so adversely upon her, that it affected her whole body unpleasantly, and began to produce spasms as soon as I repeated it.

35. As I was recounting all this to a friend, and, in order to show him distinctly how I had operated upon my patients, drew the same rock-crystals along over his hand, he looked at me with wondering eyes, and said that he *himself felt the same* that I had been describing to him of my patients,—the cool breeze quite distinctly,—as often as I passed the point of the crystal over his hand. He was a strong healthy man, in the prime of life, who allowed me to name him openly, and to call upon him, as a witness,—Mr. Carl Schuh, a private gentleman residing here, well known for his great knowledge in natural sciences. After that, I made the experiment on all my own circle of acquaintance, and on many strangers, among whom were physicians, physicists, and chemists. I have permission to name

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* I borrow the term "sensitive," for magneto-physiological reaction, from vegetable physiology, in which plants of definite irritability—such as certain Mimosas, Berberis, Dionœa, Hedysarum, &c., are called "sensitive," in distinction to "sensible," belonging to the theories of animal life, which, as is well known, involve a more general idea.—*Author.*

especially among these, our renowned naturalist, Prof. Endlicher, chief of all the public botanical institutions. It appeared that not only my sick patients, but a great many other persons, shared these sensations, and that a large crystal of quartz, selenite, heavy spar, fluor-spar, and other substances, carried along sufficiently close over an open hand, produced, and rendered evident to the consciousness, in a tolerably large number of persons, certain peculiar sensations, which manifest themselves in the first place as heat and cold. This was equally the case when I previously heated the crystal to the temperature of the blood, to meet the objection, that the sensation might be accounted for by the radiation of heat from the hand to the stone. Many could tell me at once, with the face averted, whether I had made the pass over the hand with the positive or negative, *i. e.* with the weaker or stronger pole.

It results from all this, that the following laws exist in nature:—

a. *A peculiar, hitherto overlooked force, resides in matter which, when the latter has taken the form of a crystal, appears effectively in the direction of the axes.*

b. *It manifests itself most strongly at the two poles, but differently, and in an opposite manner, at each.*

c. *Its effect agrees perfectly with that of the magnet, and the magnetic poles, in every case, where it is directed upon sensitive human organs.*

36. In order to put every one in a position to repeat the experiments on his own acquaintance, I observe expressly, that a large free crystal, with a natural point, is requisite; larger in proportion as the person is less sensitive. Heavy spar, fluor spar, and selenite, are especially well adapted. It makes no difference whether the skin is delicate or coarse; I have sometimes found the roughest mechanic's hand more sensitive than the softest skin of a professional person. The point of the crystal must be carried slowly, as closely as possible without actual contact, sweeping from the end of the arm over the inside of the expanded hand, through the palm, and over the middle finger as far as the tip, at such a rate that one pass occupies some five seconds. The crystal is to be held perpendicularly to the surface of the hand. Among my own acquaintance I have found more than half the persons sensitive. I never told them what I had in view; I asked for the hand, passed the crystal a few times over it, and then asked whether any effect was felt, and of what kind? The answer usually was, a cool or a warm breeze. It need scarcely be mentioned, that this sensation is very delicate and fine; for, if it affected the hand so strongly as not to require any particular attention, it would not have remained to be discovered, and brought for-

ward now, but would have been long since generally known. Persons who do not feel it one day often feel it the next, or the day after, or a week later. I met with a remarkable instance in my own younger daughter, Ottone. She always felt a large selenite crystal very distinctly, while her brothers and sisters could scarcely feel anything. She suffered for some time from head-ache, which gradually increased; at last she was obliged to lie down. Two days after, she was seized for the first time in her life with violent spasms, lay sick a fortnight, and then recovered. Now, however, she scarcely felt the selenite crystal at all; the attack of illness had wholly removed the sensitiveness to it. Thus this sensitiveness varied even in the same persons at different times, and with their state of health. Very frequently the sensation did not become evident at the first, but at the second or third pass. Sometimes a person felt the first pass most strongly, the second and third were not perceived, while with the fourth and fifth the sensation again distinctly presented itself. It would not do to make the pass too rapidly; the full action requires some little time. It occurred also, that it preceded the crystal, and was felt at the points of the fingers when the crystal had only reached the palm of the hand; on the contrary, it only manifested itself distinctly in other persons, after the crystal had completely passed off the hand. In some places the eyes of the persons have been bound, and then varying statements have been received. This cannot astonish, after what has just been said; the answers will always be the same from sensitive persons; from persons but slightly sensitive they will be the most uncertain; the binding of the eyes places people in an unnatural and unquiet condition, so that their attention is divided and distracted, and the requisite calm for such delicate observations is usually wanting. If many persons are present, saying and asking all kinds of things, walking to and fro, and the agitation and distraction are increased, it is natural that the answers to the questions should be incoherent concerning a sensation which does not sweep over the hand like a wire brush. To many persons the reversed pass, from the hand upward toward the arm, is more evident than the downward pass. But some persons are absolutely insensible; and these perhaps are the healthiest. The one, the northward pole,* usually acts more strongly than the other, the southward pole; the slight warmth is generally less perceptible than the coolness. It almost always contributes to increase the distinctness and strength when the hand is extended in the direction of the meridian, with the fingers directed to the south. Unfortunately, no further contacts may be allowed to exist during this, because they injure the delicacy of sensation, and divert the attention, which must be wholly concentrated here. It is worthy of remark, that this, like every other sense, becomes improved by practice. A person who never drinks wine, coffee, or tea, can seldom distinguish the different kinds of them; while a practised drinker discovers the slightest difference at once and distinctly. Mr. Schuh prepared for me in a short time series of crystals completely agreeing with those which the sensitive patients had formed. The same was speedily effected by Mr. Studer, a young man from Zurich, staying here, and his series agreed almost perfectly with that of Mr. Schuh.

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* On account of the difficulty of language, to name the poles of magnets in contrast to the poles of the earth, in so far that the latter possess a magnetism of the reverse direction to that of the oscillating needle, and in order briefly to dismiss all circumlocutions and misconceptions, I shall in this work name that pole of the needles which freely turns to the north, the "northward pole" (*gen Nordpol*), and that which points to the south, the "southward pole" (*gen Sud-*

37. Up to this point it was made out that in crystals resides a force of a polar nature, which they possess in common with magnets. It was next to be inquired whether this was of the same kind, and perhaps only quantitatively different, or was qualitatively different from that which we have hitherto understood by the term magnetism. If the former, it must be capable of being reduced to the same laws. It should attract iron filings, like not only magnetic nickel (chromium, manganium, cobalt*), but also oxidized bodies, even impure ores like magnetic iron-stone. Moreover, it ought in like manner, in quartz, selenite, &c., as it does in steel, not only to influence organic living bodies, but also convert bodies capable of becoming magnetic, such as steel, iron, nickel (cobalt, &c.), into magnets, when applied to them in the same way. When I dipped the polar end of my crystal into fine iron filings I could not detect any attraction. In order to have at my disposal the crystalline force, in its greatest possible strength, I bought the largest crystal that I could obtain, a prism of rock crystal from Gotthard, of eight inches in diameter, a six-sided colossus, with pyramidal ends, which I had some difficulty

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pol). These terms will perhaps be found fault with here and there; but in their compressed brevity, they will everywhere be readily understood. Even in the newest German text-books of physics, those just issued from the press, that of MM. Pouillet and Müller, and that of M. Baumgartner, the terms are in direct opposition; and what the former called north polar, the latter speaks of as south polar. That the German and French on the one hand, and the French on the other, have long used opposed expressions, is otherwise well known. Hence results difficulty and confusion, and this may justify the proposition of an expedient.—*Author's Note.*

* It must be borne in mind that the present treatise was written more than a year before Mr. Faraday's researches appeared.—*Author's Note.*

in using, and the action of which on the hand of the most sensitive of my healthy friends, Mr. Schuh, was so strong that he described it as feeling as if cold air were gently blown upon him through a straw. I placed a fine sewing-needle before this powerful crystal, and rubbed this with it in the same way as we do with a magnetic bar when desiring to convert it into a magnet. I made a dozen passes over it, and tried it with iron filings; it did not attract any. I repeated the passes more than a hundred times; but still it did not lift even the most minute of the iron filings. As a counter-experiment, I made a single pass over the sewing needle with the small magnetic needle which Miss Sturmann had found weaker than the little rock crystal previously applied to her, and it at once took up a long beard of filings from them. *Therefore the points of the crystals could not inoculate the needle by rubbing, with a force capable of acting on iron.* However, were this the case, it was still possible to excite such on it, after the manner of magnetic distribution, under the immediate influence of a crystal pole, and to render it capable of attracting iron filings in the same way that an iron rod is made to do so, by placing the pole of a magnet upon it. To try this, I attached a fine steel needle to the points of various large crystals, and dipped it, in this connexion, into filings. *It did not take up the least trace of them.*

38. When I approached the polar points of any crystal, even of the great rock crystal, to the most sensitive suspended magnetic needle, they never disturbed it in the least; it remained motionless. On the other hand, I suspended a large crystal (free from iron), for instance one of selenite, by the middle, with a twisted, very fine, silkworm thread, so that it swung with its long axis horizontal, placed it under a glass shade, and laid a magnet quite close to it; but this exhibited no action, and no kind of turning occurred.

39. I wished to see whether a polar wire would act upon a suspended crystal as upon a magnetic needle. I arranged a small voltaic pile of a few elements, each of about ten square inches surface, and connected the poles by a stout copper wire. I then suspended a selenite crystal, free from iron, and about four inches long, by a silkworm thread, so that both poles were free to move in the horizontal direction. When approached to a horizontal part of the polar wire, the crystal and wire were indifferent, and not the slightest visible reaction took place.

40. It still remained to be investigated whether the crystal would induce a momentary current, like a magnet, when brought near a conducting wire. I formed a helix of about twenty-five turns of strong, covered copper wire, and connected it with the couplings of an extremely delicate Schweigger's multiplier, the well-known differ-

ential galvanometer; when I rapidly inserted into the helix a selenite or rock crystal, each of several inches long, the astatic needle did not exhibit the slightest divergence. When withdrawn the case was similar, the needle was motionless; the weakest magnetic needle that I substituted for the crystals, in a counter-experiment, immediately produced a divergence of twenty-five degrees.

41. The relation to terrestrial magnetism was here a question of the greatest importance. We have some old researches by Hauy, Biot, and especially Coulomb, in which, not indeed the proof, but the possibility is made good, that all bodies may possess magnetism to some extent, or are capable of acquiring it. Those of Hauy (Mém. du Mus. Par. 1817, p. 167) may be passed over. M. Biot, in his essay on this subject (Gilbert's Annal. v. lxiv. 395, 1820,) is uncertain whether it is magnetism; or, as he interrogatively expresses it, "some other analogous force," which acts upon bodies. But in this treatise also we find throughout only such bodies denoted as more or less evidently contain iron. An experiment was made with two silver needles, one of which was made of chemically pure silver, the other of silver which had been melted with iron, and which, as no trace of iron could be detected in it by chemical analysis, was also regarded as perfectly pure. But the latter acted 416 times as strongly upon the magnet as the former. It was thence concluded that this also must contain iron, even though it could not be detected chemically, and that, as a general rule, inconceivably small quantities of iron are always sufficient to give a body the capacity to acquire magnetism; indeed, that, consequently, even the needle made of chemically refined silver must have retained traces of iron. The most detailed account of these matters was read by Coulomb, before the French National Institute, in the year 1802 (ext. in Gilbert's Ann. xii. 194): in this he left the question unsettled whether the bodies which he tried were free from iron or not, and Gilbert remarks, with reason, that they scarcely could be. The experiments consisted essentially in this: needles of about one-third of an inch long, suspended by silk filaments, were brought between the magnetic poles, and made to oscillate previously and afterwards. The number of oscillations in the same time was always smaller previously than when they were counted between the poles; and thus the effect of the magnet was indicated. But what effect? one must ask. And every one must see that it may be one of three kinds:—1. Dependent on the presence of iron in the bodies. 2. On the bodies themselves. 3. On "another analogous force," as M. Biot conjecturally expressed himself. The decision of these questions, so far as they bear reference here, appeared to me to require a new direct experiment. I

possessed crystals, especially of selenite, which acted upon all the patients as strongly as a magnetic bar capable of supporting five to seven pounds. A bar of this kind, suspended by a common linen thread, invariably arranged itself in the direction of the magnetic meridian. If, then, the peculiar, equally powerful force, which resided in the crystals, were the same as that in the magnet, the crystal when freely suspended ought to arrange itself in the meridian. To ascertain this I freely suspended various crystals, free from iron, and in particular the selenite of two inches long, by a silk thread, three twenty-fifths of an inch long, and untwisted, just as it had been wound off from the cocoon, and I brought these under a glass shade. They stood at rest for several hours, but never in a direction toward the north, or indeed in any determinate direction whatever. When I turned the point of suspension a quarter of a circle, the crystal was also diverted ninety degrees after some hours' rest. I could thus bring it completely into any direction I pleased. Therefore not the slightest opposition to the force of torsion of the finest silk filament occurred, and the *crystal force does not endow its conductor with the slightest directive power; it does not stand in any relation of direction to terrestrial magnetism.*

Consequently, as on the one hand the behavior of the magnet and of the crystal to animal nerves was exactly the same, so on the other hand, to iron, to the electric current, to the opposite poles of the magnet and to terrestrial magnetism, it was wholly different.

42. It is therefore established *that, the polar force which resides in crystals,* and renders its existence manifest by sensuous excitations of a peculiar kind, in the healthy and diseased animal nerves *is not identical with the magnetic force* as we at present know it. It does not attract iron, does not act upon the magnetic needle, is in its strongest concentration incapable of exerting the slightest power of magnetically attracting iron, in the smallest steel fibres, does not influence the polar wire when placed in the helix, does not produce any induced current, and does not obey terrestrial magnetism.

43. On the other side it holds good, that, *the magnetic force, as we at present know it in magnetic iron-ore and in the magnetic needle, is associated with that force which we have just become acquainted with in crystals.* For since the magnet acts upon animal nerves in the same way as crystals, it possesses in addition to its own properties, which are wanting in crystals, at the same time that force also which resides in crystals.

44. From which it further necessarily follows, that *the force of the magnet is not,* as has been hitherto assumed, *single in its nature, but of two kinds, since to the older known one is now added a new un-*

known one, distinctly different from the former,—that of the crystal. It may appear divested of the other properties of the magnet, and in nature is displayed in a separate condition by the crystal.

The phenomena which the magnet presents may be divided therefore into two sections, which become complicated with each other in their manifestations; and it will be necessary to subject a portion of the great store of them which science has accumulated to a process of revision.

45. I now instituted investigations as to the nature of these new properties of crystals. In the first place, I sought to make out whether this force might be transferred, conveyed, or accumulated? Whether, and what analogies, it possessed in these respects to magnetism and electricity, which can be conveyed, displaced, conducted, and concentrated. Since first of all I possessed no other magnet but the excited animal nerves of healthy and nervously diseased persons, while the excitability of the healthy persons I have hitherto met with is so weak that a distinction by degrees did not warrant sufficient accuracy, I was compelled to apply myself to the more acute sensations of the sick. For since the persons with whom I undertook the researches, placed in the most varied circumstances and suffering from different diseases, not only were consistent in their sensations, but also the statements they made, when arranged under a theoretical point of view, harmonized with each other, every reason existed to attribute value to them. I am fully aware of the objections I shall meet with here; but with the cautious naturalist, who keeps his certain steps within the boundaries of experience, they have no weight. All that we investigate of the outer material world we must, to the end, gather by our senses; we have no other instrument of perception.* We count five senses and no more; but we are

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* Even with the veneration that attends our regard for such clearness and power as are in every page evinced by the philosophical author, occasions arise to strike us with wonder that he has not studied the great work of Gall, the doctrines of which would have given so decided a direction to his extraordinary powers, that passages like those in the paragraph above could not have escaped from his pen. It is most true that in every infinitely small interval of time, countless electrical movements proceed around us, but if we study the phrenological structure of our heads, and apply the experience which numerous trials with crystals have given us, we shall easily arrive at the conclusion that the pointed end of a rock crystal, or of selenite, or of sulphate of alumina, or of nitrate of potass, or indeed of many more which have been tried, applied to the attractive organs of the brain, will excite the individual to actions agreeable to his neighbor, while the same termination applied to a repulsive organ of the brain will excite the victim to an action disagreeable to his neighbor. This is not a simple matter of theory. Numerous repetitions of the experiments have established the matter of fact. Take, for instance, a female of impressionability in a condition of lucid

already sufficiently aware that things go on in nature, and, in fact, around and in us, which we are unable to detect, only because we

somnambulism: apply to her organs of adhesiveness or of pure affection the points of rock crystals, and she is excited to the tenderest manifestations of pure affection. Change the direction of the crystals, point to amativeness, and the woman, if her organs are at all full, is unable to control her actions. She burns with desire. Reverse the ends of the crystals, the feelings are calmed, or perhaps the reaction is attended with headache. Blowing or breathing on the organs equally dispels the feelings. Now try the points of the crystals on the organs of self-esteem—most repulsive organs, and the woman becomes imperious, angry, egotistical, and desires you to stand off, for she detests you. Does all this power reside in the optical axes of crystals? The Baron von Reichenbach has beyond all doubt established the existence of a force residing in the principal axes of crystals, and the manifold relations of this great fact have yet to be fully developed by thousands upon thousands of experiments. If these crystals can excite the organs of the brain in man, and can oblige him to act according to the impulse he has received, is he not the victim of impulses? "Electrical and magnetical movements!" What are crystals but spherical or spheroidal molecules arranged by electrical currents according to determinate laws of aggregation? What are those globular molecules but imitations of the spheres which occupy space, each having its polarity, each its north and south, its east and west; each its magnetic, each its diamagnetic relations. If the crystals of Von Reichenbach can excite these phenomena, they can do much more. Many an impressionable individual may be put into a profound sleep by pointing such crystalline apices to the eyes, and awakened again with rapidity by applying the positive or butt end of the crystal to the eyes or to the pit of the stomach. I have done this upon numerous patients hundreds of times. Some individuals are so easily impressed, that I have often put them to sleep with the point of a small crystal of Epsom salt, and as often awakened them with the flat end. This force of molecular arrangement suggested to me some experiments on very susceptible patients, the details of which ought to be full of interest to philosophical physicians, for they open up fields of inquiry that should lead to the *modus operandi* of all medicinal agents. I dissolved different neutral salts in water, and experimented upon one at a time. I took chloride of sodium first; and a solution of this substance being poured into ten finger-glasses, they were connected together by cotton moistened in the solution, and a couronne des tasses was completed. A current of electricity from four of Smee's elements was passed, and sensitive persons, who could be readily put into mesmeric sleep by crystals, were desired to put the fore-finger into one of the glasses so as to allow it to be moistened by the solution. In the first trial, seven young women tried the experiment. In different periods of time, varying from half a minute to five minutes, each fell into mesmeric sleep, previously complaining of a strong taste of brine in the mouth. The next trial was with a solution of sulphate of alumina. Sleep came on in each case, varying from one to three minutes. Each tasted alum in the mouth. Two had intense headache. These in the next experiment I placed first for trial. The solution was nitrate of potass; the taste of which was very cooling and agreeable. Sleep did not supervene in one for four minutes; in the other for seven minutes and a half. Some of the others slept more quickly, varying from three to six minutes. The nitre cured the headaches. Sulphate of soda, of magnesia, of potass, were tried separately; then together. Sleep in a comparatively short time. In some, weight about the head; in others, headache. These repossess no instrument for their perception. In every infinitely small interval of time countless electrical movements proceed around us; we do not perceive the slightest trace of them. If any one were to come down from the clouds who had a sixth, an electrical sense, with which he could detect and could describe the finest electrical changes around us, with the accuracy that we do the phenomena of light by means of our optical organs, should we not eagerly listen to his teachings, and ask him thousands of questions, to clear up and extend our knowledge? One born blind, who has never had a conception of light and color, allows himself to be led by one that sees; and when he always finds the stone, by feeling, which the seeing guide had forewarned him of, he believes that the seer has eyes, which enable him to see things. Now, a nervous patient is one of this kind, in whom a sensitiveness for electrical and magnetic movements exists, and with which is unfolded to a certain extent a peculiar sense, so to speak, of which, as it will appear, the healthy are deficient. Among the nervously diseased, referable here, I do not mean directly somnambulists, sleep-walkers, &c., but, as a general rule, most persons who suffer violently from spasms. The somnambulists are only those in whom these disturbances of the normal condition of the nervous system have reached the highest degree, and in whom the excitability has reached its maximum. They give us the strongest testimony of the reactions, and show us the most delicate differences; but they are not absolutely necessary in the researches to which I de-

sults made me try the effects of various substances in solution. In one trial with sulphate of copper, finding fearful sickness and ulceration of the mouth, which was cured with great difficulty, I was induced to reflect on the danger of such trials with poisonous metallic salts; and I left off for a time, inferring that mercury might be advantageously employed where ptyalism was desired by these means of operating. I had already in several cases of somnambules made the mouth very sore, and induced salivation, by simply placing a minute globule of mercury in the palm of each hand; establishing, by producing the rigid spasm in the first place, the dictum of my two revered masters, Abernethy and Macartney, that mercury, among its many properties, was, judiciously applied, a tonic medicine. The further reflections on the influence of two poles of crystalline agency led me to pass currents of electricity through baths, which I afterwards found more extensively and ingeniously applied by Mr. Tylee, of Bath. The first experiments I tried were on myself. The currents being passed from the head towards the feet, the bath was tonic and exhilarating; but being induced on one occasion to try the current in the inverse direction, I had a most intense headache. Mr. Tylee, and Mr. Bagshaw, at Bath, have had great success in the treatment of intractable forms of disease by means of this agency. We are as yet but at the threshold of the practical applications of this subject. In every point of view, the existence of the force which Von Reichenbach has established is a vast advance upon our old stock of knowledge. There is, to the reflective mind, no limit to the relations which the force he has indicated has to all the objects in nature.

voted myself. Miss Nowotny, on whom I made my experiments, was far from being a somnambulist* during the whole time of my six weeks' study she only suffered from cataleptic spasms. Miss Maix never exhibited a trace of somnambulism. The surgeon, Mr. Schmidt, of Vienna, who experienced the most striking effect from the crystals and the magnet, as well as the terrestrial magnetism, was a young, otherwise perfectly healthy man, who merely was attacked by cramps in one arm for a short time, through exposure of one side to cold. And the sensitiveness might be thus traced onward to the healthy, who only felt the pass of large crystals upon sensitive parts, like a cool breeze. Finally, there was a further distinction even among these, that some felt the cooling strongly, others more weakly, some not at all.

If, therefore, all this stands in regular connection, cause and effect cannot be disputed away, and, in my opinion, it would not be well done to throw away results which may become so valuable a key for the investigation of truths of nature, in those branches of physics and chemistry where she seems to wish to conceal her mysteries from us most obstinately. The singular sense, the peculiar irritability of nervous patients, is chiefly directed to magnetic phenomena; they are an invaluable reagent while we possess no other. They are not vague sensations, as has hitherto been often believed, and as like those by which many physicians and visionaries have brought reproach upon themselves; but everything follows rule and law, and these are soon discovered, when one does but investigate them intelligently, trace them with the aids of physical and chemical knowledge, and apply to them the touchstone of experimental criticism.

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* It is clear that though these patients were not somnambulists, not in that which Dr. Elliotson calls the sleep-waking state, they were in the deep mesmeric sleep, of which the other is only a condition. In the hands of an experienced mesmerist, Miss Nowotny would not have failed to exhibit an immense number of phenomena known as mesmeric phenomena. I dispute not the Baron's right to establish a stand point; but while I yield to him the deep respect which is due to so philosophic a mind, I regret to observe his tardy acceptance of the truths to every one of which he will be obliged on enlarged experience to yield his assent. Without mesmeric sleep, the Baron's are just the cases which could not fail to convince him of the truths of Gall's phrenology. His fingers applied on their heads to Gall's organs for a short time, would produce manifestations that could not fail to strike such a mind as his that he has been making distinctions without differences, while he has bestowed the sneering remarks in the above paragraph on the physicians who have brought reproach on the philosophy of magnetism. Everything does "follow rule and law;" but these rules and laws are to be traced by all the lights that can be brought to bear upon them, and when certainty cannot be attained in science at first, we must be contented with probability. When we cannot establish a theory, we must satisfy ourselves with the amusing haziness of an hypothesis. If we, at last, arrive at the truth, we shall not regret the toil it has cost us, albeit much of it has been devoted to stem the torrents of prejudices, and the foregone conclusions directed against us.

I could not avoid this digression; it is indispensable to the definition of the stand-point of these researches. I now turn again to the questions, whether the peculiar force which displays itself in crystals is communicable, conductible, and condensible? When the most incongruous things, a piece of wood, a glass of water, leather gloves, paper cuttings, or any thing else, were rubbed with the pole of a crystal, every sick patient detected without delay, when placed before them, the difference between such and others which had not been rubbed. The sensation was sometimes a cool, sometimes a warm feeling, perceived by the hand in which the object was placed; and this gradually increased until it became unpleasant. The conveyance upon paper was found to be the weakest. Miss Sturmann did not feel a book which had been once rubbed with the large rock crystal; often rubbed, scarcely at all. Finally, when I had held it for a time in contact with the point of the crystal, and at once quickly placed it in her open hand, she felt a slight warmth. A piece of porcelain touched with the crystal-point, felt cool to her. A German silver conductor of an electro-magnetic apparatus, when treated in the same way, she felt very warm. A piece of soft iron, a piece of a blue steel saw blade, a hard steel file, all at first found indifferent, produced a sensation of heat in her hand after the crystal point had been drawn over them. I placed my hand in hers, first let her get accustomed to it, then took it away, and drew it backward and forward a few times above the point of the great rock crystal, and then again laid it in hers: the patient at once felt a great difference; she now found it far warmer; and this apparent elevation of temperature endured, decreasing, for more than four minutes, during which I repeatedly extended it to her for trial. A similar series of experiments were gone through with Miss Maix, and subsequently with Miss Reichel. The charge was here conveyed to copper, zinc-plates, linen, silk stuffs, and water. They gave wholly similar results. Miss Atzmannsdorfer perceived immediately whether the German silver conductor had been previously in contact with a selenite crystal or an amorphous body, and particularly whether with the warming or cooling end of a crystal the heat conveyed was stronger or weaker, or replaced by cold. The crystallic force may therefore be transferred or conveyed to other bodies. It may be transferred to iron and steel, and, at the same time, these bodies, so charged, do not attract iron filings, as I have already shown above.*

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* The Baron very satisfactorily establishes his positions. But I have tried all these experiments with great care on impressionable patients, and have frequent-

I endeavored to ascertain whether this conveyance could be effected, like that of magnetism, by rubbing from pole to pole, or,

ly been disappointed in the results. I have repeated them on somnambules, and have found every one of them come out as above described. Then I am bound to value the testimonies afforded by good sleeping-waking persons. I am often told that confusion arises from the use of such cases. Yes, in the hands of botherheaded persons, confusion naturally takes place; but with due precautions the results obtained are far more interesting, because more definite. Having prepared a case for such experiments as those detailed above in the case of Miss Sturmann, I passed the pointed end of a rock crystal on a smooth deal board, on a piece of writing paper, on the bound leather cover of a book successively. Each in turn was offered to the right hand of the patient, Miss J. D., who had been eight times put into a state of placid sleep, undisturbed by the influence of other mesmerizers. Each object felt warm and agreeable. I repeated the crystalline applications a dozen times on each object; the effect was to make the patient smile contentedly, and to place the hand eagerly on the object: at last, by repetitions of the experiment, the sleep was deepened. Now I applied the opposite pole of the crystal to the board, the paper, and the book successively, and the patient being in a deep sleep, the hand was gently laid upon the objects in turn. First, from the deep sleep, the state of sleep-waking took place, and the hand was speedily drawn away from each object as if it were disagreeable; and on being asked as to the nature of the sensation produced, she said it was cold, and made her chilly all over. I repeated the application of this repulsive end of the crystal many times to the paper, and on each renewed application of the hand the sensation became more unpleasant, and at last the patient woke up suddenly. A piece of porcelain touched with the pointed end of the large rock crystal was warm and agreeable to her, but did not put her to sleep. I held the point of the crystal to the forehead; she fell deeply asleep instantly. I touched the porcelain cup with the blunt end of the crystal, passing it a dozen times, and then touched the fingers of the right hand with the cup: the hand was hastily withdrawn, with an exclamation of "*don't—it is like ice.*" The patient had instantly passed into sleepwaking. The iron poker was treated with the pointed end of the crystal, and the application of it to the hand deepened the sleep. The same result took place when it was applied to the nape of the neck. When the opposite end of the crystal was applied, the iron being well charged with the crystallic force, the patient on feeling it got up suddenly wide awake. A three-cornered file, and a pair of large polished scissors, similarly treated, produced identical effects. To detail the repetitions of the experiments on this patient, and on two others where identical results were obtained, would be tedious. Insisting upon the fact which Dr. Elliotson's experience has fully established, and which mine and that of several other experienced students in mesmerism sufficiently corroborate, that no phenomenon is observed in artificially induced mesmeric states which has not occurred in Nature, I am induced to draw attention to some cases in which the polar relations would appear to be reversed. In general, when I took the hand of a patient mesmerized into sleep by myself, with a piece of pure gold, in a longer or shorter time, according to circumstances of impressionability, the hand and arm became rigid. If I apply the gold to the nape of the neck, the whole body becomes rigid, and the sleep is so deep that the patient is insensible to all impressions. If, in this state, any of the metals easily oxidable are applied to the same spot, the sleep and rigidity in times varying according to circumstances are dissolved, and the patient is restored to the vigilant and conscious state. I have like that of electricity, by single points. It proved to be indifferent whether I rubbed the object in the direction of its length, or kept any point whatever for a short time in contact with the point of the crystal; the warmth or coolness thus produced were not found to differ. A large crystal, when the point was applied to a glass of water, produced magnetized water, as well as a horse-shoe magnet.

46. The question now was, whether a coercive power existed in matter, whether this charge was persistent or transient, and after what intervals of time? I charged various objects,—the German-silver conductor, the steel file, the soft iron, the piece of porcelain, and the book. The last soon lost its power. The piece of porcelain tried on Miss Sturmann retained it two minutes, the conductor five minutes, the iron the same, and the steel ten minutes. In this operation I did not take the objects in the free hand, but moved them backwards and forwards in a fold of paper; when the patient had taken hold of them, I made her lay them down, and wait till the sensation which

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performed analogous experiments with different metals hundreds of times; but I have occasionally met with cases of a high degree of impressionability, in which most unexpectedly the phenomena were nearly all reversed. By the induction of the rigid state with gold and platinum, I have repeatedly cured menorrhagia in females. A married woman, aged 23, with dark hair and eyes, highly nervous temperament, afflicted with passive hæmorrhage, occurring for a fortnight at each catamenial period, was mesmerized easily into a sleep-waking state, in which she remained quiet and comfortable for a couple of hours each morning for a week. She was cured, and remained well for four months. The vexations arising from questions relating to a drunken husband made her suffer much from headache, and I applied a disc of pure gold to the back of her neck. Instead of sleep and rigid spasm increasing, she was affected with the clone of hysteria, and sudden passive hæmorrhage. I applied soft iron to the neck and soles of the shoes, and in half an hour she was quite well, and in high spirits. I persuaded her to come the next day, and put her to sleep by passes, after which I applied a disc of platinum to the nape of the neck. The same results as with gold immediately supervened. Waking up suddenly, she became very hysterical, and hæmorrhage quickly came on. The cure was just as soon effected as before, by the application of iron to the neck and soles of the feet. The general conclusion at which I have arrived, that all attractive agencies tend to produce a state of nervous system favoring tone, and that all repulsive agencies tend to produce an opposite state favoring clone, was here subverted by an exception; but what does it evince? only that cases exist in which the relations to the metals, and to the poles of crystals, are directly the reverse of those usually met with. I have seen two other cases, in which, though not identical, yet very analogous facts were exhibited, in which the pointed extremity of crystals induced wakefulness and headache; while the blunt or butt end being offered to the eyes or to the pit of the stomach, deep sleep was immediately brought on; in which magnetized water induced no attraction of the hand, and in which the presence of a powerful magnet brought on hysteria and headache; but no subsequent rigidity or sleep. They were of a nervo-bilious temperament, liable to frequent attacks of nervous and sick headache.

continued to thrill through her hand had disappeared. This required about a minute. Then I made her take the object up again, without having touched it myself, and continued thus until the sensations of heat or cold were no longer produced. From this it follows that the retention of the charge, under the above circumstances, is not, even at night, of long, but of short duration, and, indeed, at most of ten minutes; that the charge soon disappears again, and, unlike magnetism, it cannot be permanently ingrafted upon steel. Since the iron filings fall from an iron bar which has been placed within the sphere of distribution of the magnet directly and instantaneously when the magnet is removed, but here an effect of accumulation does occur, although but for a short time, the question must be answered thus: that some, even if weak, coercive power over the crystallic force does actually exist in all bodies, which for magnetism, so far as we know it at present by its polar effects, is not the case, since the coercive power, according to our actual knowledge, is limited to an exceedingly small number of bodies; in fact, according to the most recent researches, strictly to iron and nickel.*

47. Is the crystallic force capable of being isolated, arrested, or is it universally distributed through matter? The first experiments were made with Miss Sturmann, who, though sensitive to the magnetic excitement, was less clear in her perception of it as to the distinction between warmth and cold. When I placed a book upon her hand, and brought the point of the large rock crystal upon it, the hand felt nothing of it through the book. Since she had previously felt the approach of the crystal to the inside of the bare hand at a distance of 18 or 20 inches, while now the distance was no greater than the thickness of the book, that is, four-fifths of an inch, this experiment showed that a thick mass of paper was a substance capable of arresting, at least for a short time, the action of the crystallic force upon the nerves of this patient. A piece of deal board acted in a similar way, but less perfectly.† After a short interval the alteration of

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* Written a year before the recent researches of Mr. Faraday.—*Author.*

† The crystallic force, residing most probably in the optical axis of the crystal, since it has so close a relation to light in some form, in producing sleep and vigilance, according to the pole of the crystal offered to the face or pit of the stomach of a very impressionable subject, has been demonstrated here very frequently. I have seen cases in which the pointed end of a large rock crystal has, by being presented in the direction of the individual, whose back has been turned to the operator, induced sleep instantly at the distance of 42 feet. The other end immediately caused wakefulness; and in this manner sleep and wakefulness were alternated just as often as the crystal was turned round. But even in less susceptible cases, the point of a rock crystal would, with its attractive or repulsive pole to the individual, induce sleep, and the other pole would awaken. Often

temperature began to be weakly perceptible beneath it. Eight folds of printing paper soon allowed the force to act through them; four folds of woollen stuff scarcely offered any perceptible obstacle. A porcelain dish, lying in her hand, touched on the upper side with the point of the crystal, was felt to be cool when I turned it over after the contact. On the contrary, an iron plate gave a warm sensation, when placed on the hand, as soon as I brought the crystal near; when I put it in contact the effect was like a shock, ascending through the elbow-joint to the shoulder.* Various metallic wires, held in the hand by one end and touched with crystal points at the other, gave sometimes warm, sometimes cool sensations, without exception. I placed one end of the German silver conductor in her hand, and placed the other end in contact with the point of a small crystal; the sensation of an alteration of temperature shot instantaneously from the hand to the elbow joint; when I operated in the same way with the large rock crystal, it ran up as far as the shoulder, and produced cramp-like sensations.

When I subsequently repeated the same experiments on Miss Maria Maix, action took place through all bodies without exception, only it was more rapid through metallic, more like a shock, so to speak, than with vegetable substances, tissues, &c., which required a short interval of time for the effect. I made experiments with wool, silk, glass, and zinc on Miss Reichel. The transmission through

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and often has the experiment been satisfactorily performed by an operator going into one room, leaving the patient in the adjoining apartment, separated by a partition of deal wood painted, which was covered on one side by prints framed and glazed. As often as the respective ends of the crystal were held towards the patient, instant sleep or instant vigilance were produced. Any person standing in the door-way, so as to observe both the operator and patient, could at once see that there was no possible source of fallacy in the experiments. Many patients have been submitted to the test of this experiment, and the results have been identical.

* These experiments I have repeated on somnambules with precisely the same results; but in sleep-waking persons, as in those quite wide awake, there are many varieties in the degrees of susceptibility. A piece of cylindrical wood has been held in the two hands of a sleep-waking patient; it has been touched with the pointed ends of a rock crystal; immediately the wood has been strongly grasped by the patient, in some cases with, and in some without, the shock being experienced, but deeper sleep has supervened. The opposite end of the crystal touching the wood, wakefulness has taken place, and the piece of wood has dropped from the relaxed fingers. If an iron rod, of the diameter of an inch and a half, has been used instead of the wood, the sense of shock up the arms has been more decided, and some have complained of its burning the hands. Some have slept only more deeply. The law regulating the results I believe to be dependent upon the presence of attractive and repulsive agencies exercised by the crystals.

wool required a short moment of time in a cord 40 inches long; but with silk, glass, and zinc, it was instantaneous, and of immeasurable rapidity. My experiments on the very sensitive Miss Atzmannsdorfer furnished similar results; brass wire, the German silver conductor, glass tubes, leaden bars, platina foil, bar iron, gold threads, and copper plates, which I placed in her hand, were instantaneously traversed by the force which passed into them by contact with the crystal. The conclusion is, that the *crystallic force acts through all bodies, but in different degrees.** Paper, wool, and wood, render the passage difficult, at least for a short time; porcelain less so; silk and glass are perfect conductors. Metals permit the passage not only on actual contact, but in slight degrees even before the contact, on mere approximation; but on contact an immediate action ensues. So far as these preliminary tests allow of a conclusion, they indicate that the difference of conducting power of bodies depends less upon their nature than on their continuity. All tissues conduct worse than solid bodies; cotton and wool worse than wire, silk, &c. The completeness and rapidity of the conduction were experienced in different degrees by patients of different states of sensitiveness, in such a way that while to the more sensitive everything is permeable, with the less sensitive occur distinctions among the bodies in the degrees of the permeability by the crystallic force.

48. I still wished to test the magnitude of the capacity for being charged. I made passes and contacts on the conductor and the steel file a varying number of times. One pass acted evidently more weakly than several; but when I had occupied a minute in the charging, it attained a magnitude which, under the given circumstances, was insusceptible of further increase, at least of an increase of strength of the sensations of warmth and cold thereby produced on the hand of the patient; to which corresponded the frequently repeated trials of the persistence of the charge, which never endured more than about five minutes, however much time I might have consumed in it, excepting only on steel and water, where it was felt about ten minutes. The charge was not effected instantaneously, but increased during the contact for a short time, and then attained its maximum. *This capacity for a charge was satisfied in a few minutes.*†

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* A just conclusion, strongly corroborated by numerous facts observed in the course of experiments on sleep-wakers.

† The same conclusion is arrived at in relation to charging bodies with the mesmeric fluid. Water holds only a definite charge, according to the concurrent testimony of many lucid sleep-waking individuals, taken at separate times. Thus, I have darted my fingers two hundred times on the surface of a tumbler of water, and have been told that the blue haziness has overflowed the tumbler.

49. In reference to the magnitude of the force and its relation to the size of the crystals, the experiments showed that a small crystal, from the size of a lentil to two inches long, if of gold, rock crystal, selenite, diamond, or hornblende, was weak, and only actively perceived in the reversed pass upward; *that from this point the force increased with the size of the crystals.* The exponent, of course, could not be made out as yet.*

50. The distinction of the poles, in reference to their power of affecting the nerves, was expressed by an opposition of cold and heat. Almost in every case the crystal produced cooling with one pole and warmth with the other when drawn over the hand. Miss Nowotny, and the surgeon Mr. Schmidt, in the upward pass felt, like the healthy, a cool pleasant breeze; in the downward pass a not disagreeable gentle warmth. I tried crystals of tourmaline, arragonite, rock crystal, selenite, and cleavage forms of Iceland spar and tellurium, on Miss Sturmann. All presented a stronger cooling pole, and a weaker warming one. This difference was very clearly marked with Miss Reichel, who distinguished the poles of all crystals, even at some distance, by a sensation of cold and heat; and this with very great accuracy. As I have already mentioned, Miss Atzmannsdorfer felt it most strongly. But even healthy persons, *e. g.* Prof. Endlicher, as already mentioned, Mr. Studer, my servant Johann Klaiber, and others, distinguished the two poles of all crystals very accurately, even of very small ones. *The opposition of the two poles of crystals,*

Several persons have said precisely the same thing. In mesmerizing a decanter of water, I have placed a watch before me while I held the tips of my right-hand fingers in the mouth of the decanter. Several lucid individuals have separately indicated the precise height of the blue haze in the water at the same interval of time. A few minutes were sufficient to charge a quart decanter. All concur in the fact that the fluid sinks in the water. Is it, then, imponderable? Has it not a specific gravity?

* Experiments in sufficient numbers are wanting to determine the relative powers of dissimilar crystals. There is no doubt of the crystalline force being, cæteris paribus, augmented in a ratio to the volume of the same kind of crystal; but the force will be found to vary much in power according to the nature of the constituent substances of the crystal. Clear rock crystals are more agreeable to patients than fatty crystals. A rock crystal containing titanite was disagreeable, but it put patients into a deeper sleep than the clearer specimens. A very small crystal of cobalt is more powerful than a large rock crystal. In highly susceptible cases, the pointed end of a very small crystal of Epsom salt held to the forehead or to any part of the face has been sufficient to induce sleep immediately, and wakefulness has been speedily produced by holding the opposite pole of the same substance in the same direction. A crystal of morphene held in the same manner has been attended with the same results, but accompanied by headache. "The opposition of the two poles of crystals expressed itself upon the nerves at once by these striking contrasts."

therefore, expressed itself upon the nerves at once by slight heat and cold. I shall hereafter detail some other contrasts.

51. The high degree of distinctness which the excitement possessed in sick persons is worthy of notice. Not only do they perceive it universally on the masses of bodies which are brought to them, but they clearly perceived that there are points at which the force is concentrated. Miss Nowotny pointed out to me very definitely, in every crystal, the spots where effective poles were situated, which she very quickly discovered with the tips of her fingers. In double crystals the axis always passes through the line of junction of the two crystals. Miss Maix, Miss Sturmann, Miss Reichel, and Miss Atzmannsdorfer, had the same power, in some cases with still greater readiness. Even Mr. Schuh and Mr. Studer accurately felt out the points on large crystals, and their observations all agree accurately with one another.

52. *The crystal-electricity*, as excited in tourmaline and other minerals by heat, does not exhibit any perceptible effect upon the nervous excitement produced by the crystallic force. I heated these bodies to different degrees, but they produced *no evident modifications* in the effects.*

53. Does the crystallic force stand in no relation of direction to terrestrial magnetism? Starting from the manner in which crystals are built up, one would be induced to conjecture that the two forces are really to a certain extent independent of each other. Whoever has seen a nucleated mass of quartz crystals broken into, in a mine, and noticed how they stand in all directions, cannot have overlooked that the entire cavity is clothed on all sides, above and below, with crystals whose axes are directed in every possible direction. But without going into a mine, this observation may be made at once in a cabinet of minerals, upon the well-known balls of chalcedony, the cavity of which, *i. e.* the nucleus, is clothed all over with crystals of quartz and amethyst; I have never been able to detect anything like an uniform direction. Other crystallizations, again, which are grouped in stalk-like heaps around a common central point, like natrolite, zeolite, mesotype, arragonite, pharmacolite, &c., form tuber-

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* I have coiled copper wire enclosed in silk thread round eight large rock crystals, and have thus produced an instrument like an electro-dynamic coil, furnished with a platinum keeper. The crystallic force was not increased in the least perceptible degree, nor have I found the crystallic force modified by heating or cooling crystals. As mesmeric sleep-wakers of high susceptibility are so much more delicate than any person awake can possibly be, the testimony derived from experiments on these must be powerfully corroborative of the Baron's conclusions.

cular globules, the rays of which spread out in all directions, and no indications lead us to imagine an influence or any kind of external directing force on their formation. Our own crystallizations, as they go on in our laboratories and manufactories, are in like manner usually altogether confused; prussiate of potash, alum, sugar of lead, sugar-candy, &c., deposit their crystals, in large vessels, without any choice of direction. This appears to agree with the indifference which free crystals observe towards the magnetic needle and the polar wires. *On this side, therefore, the crystallic force is independent of terrestrial magnetism, in reference to the direction of its structures.*

54. Since now the crystallic force shows itself to be free from that attraction to inorganic substances which so remarkably distinguishes the magnet from all terrestrial things, it must, on the other hand, prove the more striking,—nay it seems to claim the highest degree of interest in natural science,—that *it shares with the magnet the singular power of attracting living organic bodies.* For as I have already minutely described, I saw the effect produced by the magnet upon the cataleptic Miss Nowotny, repeated when she was brought in contact with the points of large crystals. It contracted her hand, in some cases produced cramp, and attracted her hand to follow it, not so strongly as a large magnet, but exactly in the same manner as a weak one. I am certain that if I had possessed a crystal large enough, her hand would have adhered to it, both in the unconscious and conscious state, just in the same way as it did to a strong magnet. *This elective affinity of the crystallic force* to attract living and not dead matter is the most extraordinary character it displays, and points to the powerful connection in which it stands with the inmost essence of that which we call life, and respecting which, if I am not most grossly mistaken, it promises closely imminent, and most important results.

55. In a former treatise I gave an account of the light which issues from the poles of a strong magnet. After that observation, it was very natural to imagine the possibility of the same at the points of crystals; indeed, there was great probability in the anticipation. I therefore instituted an experiment with the heightened vision of Miss Sturmann. A room was made as dark as possible; she entered, remained some time, till her eyes became accustomed to the obscurity, and then I placed before her the large rock crystal. She actually *at once perceived a flame-like light over it*, half the size of a hand, blue, passing into white above, remarkably different from the magnetic light, which she described as much yellower and redder. The experiment was repeated twice on the following night. In order

to obtain as complete conviction as possible before Miss Sturmann came into the darkened room, I placed the large eight inch thick rock crystal upon a place which she could not be aware of. As soon as the obscurity was fully restored by shutting the door, she in every case immediately detected the place where the crystal stood, and saw the flaming light exactly the same in all these three experiments. She described it as somewhat resembling a tulip in shape, and beginning below with a curve directed outward, like one of the petals, or like a candle-flame, but then soon taking an erect position and rising to about the height of her finger's length. She again spoke of the color as blue, passing into perfect white above, and in such a manner that isolated scattered streaks or filaments of a reddish color ran up in the upper part of the white. The flame was moveable, in a waving and sparkling condition, and threw a light glare over the support on which the crystal rested, of the diameter of almost forty inches, just as a magnet had done, when flame-like appearance and light radiating from it could be clearly distinguished. From her I turned to Miss Reichel, and placed various crystals before her in the dark. She everywhere found the flaming appearances bright, surpassing those of the magnet in brilliancy of color and regularity of form. The light was with her visible not only over the poles of the crystals, but even in the interior of their substance. She described the flame over the poles much in the same way as Miss Sturmann, but the appearances of light in the interior essentially different from this. She said that they were of peculiar star-like forms, which assumed different shapes when the crystals were turned. It was evidently the crystalline structure of the stone, its lamination in different directions, which caused the production of luminous appearances and internal reflections, such as of course could not exist in this way in a steel magnet. She furnished me with drawings of the lights of large and small crystals, which represented most astonishing appearances. I reserve all the various magnetic luminosities, which I became acquainted with, to bring them together hereafter in a special comparison, and shall give figures of Miss Reichel's drawings of the crystallic luminosities with that. Miss Maix also, whose calm and accurate mode of observation I especially valued, for many nights that I left the great rock crystal upon her stove, beheld in her sleepless hours the beautiful spectacle of a whitish star, half the size of her hand, on the apiculated summit. Miss Atzmannsdorfer in all cases pointed out the luminous pole in the dark, in a number of different crystals, and placed them in a series for me, according to their strength.

Since, then, all the crystals, which I had subjected in such great number to the test, exhibited the same reactions in reference to that peculiar force, which they manifested at their poles, as occurred in its maximum in a large rock crystal, one is led to the conclusion that *crystals in general, like the magnet, emit a fine flaming light from their poles*, usually invisible to healthy eyes, but seen by those of excited nervous patients, in whom all the senses exist in an unusually acute condition. I need scarcely mention that this bears relation to the luminous appearances frequently observed during crystallization itself by chemists, which have long found place in the text-books. The nature of these radiations has not yet been explained; they have generally been assumed to be electrical, because they look like such, but no direct proof exists. Prof. H. Rose, however, has lately shown that this light is not connected either with heat or electricity, since neither the air-thermometer nor the telescope is affected in the least when dipped in a crystallizing solution of substances which exhibit the highest known degree of evolution of light in the moment of crystallization: for example, sulphate of potass and soda (Poggend. Annal. LII. 443, 585). But now that we have become acquainted with the permanent luminosity of crystal poles, which at present exhibits no agreement with electricity, but indeed a great difference, it becomes highly probable that the said light is dependent, not on electricity, but on the evolution of phenomena of crystallic light, and that circumstances arise in the sudden conveyance of the molecules suspended in the fluids into solid crystalline bodies, under which the crystallic light becomes so concentrated as to be visible to common eyes. What this light is, which *like sunlight beams continuously*, without in the least diminishing the body from which it radiates, whether it is a vibration propagated in the surrounding fluids, I leave here untouched. We assume that the atoms, still more the molecules of matter, are polar; we regard them as the elements for the construction of the crystal. Is their arrangement into a large solid crystal, which again has its own polarity and is luminous at its poles, a sum of all these little polarities, and are its poles an expression of this, as the open poles of a voltaic pile afford the sum of the shares of electricity of all the individual elements? Is a crystal a pile for the crystallic force, as the voltaic is for the electrical? These are approaching questions reserved for further investigation; meanwhile the consistent observations here made, and often repeated, on five different sick persons, will soon find confirmation in other places and by other observers; only I caution them not to undertake the experiments with somnambulists in the sleep-walking condition, but either with others, not-somnambulist, nervous patients, or, if none such can be found sufficiently sensitive, to take the somnambulists only in the awake, conscious condition, when their senses are clear; and not to make use of the sleep-waking condition at all, or at most solely for the control of the former. I have never employed the patients in the magnetic sleep or somnambulism in my physical investigations, but when in this condition have left them in the hands of their physicians, and contented myself with the position of a spectator. To prevent errors, I again remark, that when it is wished to repeat my experiments, the place must be completely darkened, so densely that even after a long stay in it, after one or two hours, no trace whatever of light can be detected: finally, the crystal must be very large, for mine, as I have already mentioned, was not less than eight inches thick, and proportionately long. With those, however, who are strongly sensitive, smaller crystals will answer the purpose, since Miss Reichel and Miss Atzmannsdorfer saw light issue from almost every crystal, especially from compounds of sulphuric and fluoric acids, which in all cases surpass rock crystal of the same size.

56. All these researches finally unite to show, that the peculiar force of crystals here developed, opens a new page in the book of dynamics,—that it certainly falls within the general laws of these, but possesses its special code, to study which, and bring their axioms to mathematical expressions, must be henceforth one of the tasks of physics. It will be above all desirable to find some universal inorganic re-agent upon it, to discover an instrument of detection and measurement, which shall free us from the often worse than painful dependence on sick persons, hospital patients, and unscientific persons of all kinds.*

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* The reflection that it would be desirable to find such a re-agent is natural. It is not so difficult to measure heat, light, electricity, and magnetism. These are agencies that are common to inorganic and organic matter. But it is a question whether it is easy to devise a test for a force owing its existence to a combination of molecules that constitutes an organic arrangement, which in its own nature shall not be organic. Is it possible to find an inorganic test for an organic force? We may probably, by tracing the laws regulating organic forces, be enabled to find out the means by which the human being can be stimulated to become so highly sensitive as to detect the presence of very subtle re-agents, odors, metallic lodes, streams in the bowels of the earth, but it may be problematical whether, per contra, we shall be able to frame an inorganic instrument sufficiently delicate to detect thought, the impulses of ambition, hate, or cunning; the bewitching influences of love, benevolence, veneration, or conscientiousness. These depend upon organization; upon arrangements of living matter, so distributed in the brain as to have their own attractive and repulsive relations, but having no corresponding antagonistic forces in inanimate matter. In order to study the physics of organic arrangements, we must lay aside our repugnance to the numerous delicate phenomena offered to us in organic nature, and be content to enlarge, though in a degree hazily, our bounds of inquiry, paying respect to classes of facts that appear, and appear to proud ignorance only, the creations of fancy. Phrenology teaches us the causes of the philosopher's repugnance to new classes

RETROSPECT.

a. Every crystal, natural or artificial, exercises a specific exciting power on the animal nerves, weak in the healthy, strong in the diseased, strongest of all in the cataleptic.

of ideas. Mostly, it is to pride that he is indebted for his refusal of truth, and the silly institutions of society foster and encourage the acquisitive, the approbative, and the pride-creating organizations of man to habituate him to a love of contempt, and an adhesion to errors and fallacies. A most eminent Professor, justly celebrated for much that he has nobly wrought in science, was heard to say openly before a large audience, "Had I been *sharp*, I should have hit upon the discovery on which my competitor has stumbled:" by no means ashamed to acknowledge publicly, that he did not rejoice in the success of a fellow-laborer, who had poured the blessings of a new truth on mankind, to elevate the thoughts, to exalt the aspirations of beings whose organizations improve by an indulgence in noble aims. However vulgar and absurd, because perhaps not severely exact, to habitually erroneous thinkers themselves, may appear much of the knowledge floating among boors and peasants, a very remarkable proof of the importance of some of it may be traced to a singular though rude anticipation of a part of the most brilliant of Professor Faraday's discoveries on magnetism and diamagnetism, by means of an instrument, the name of which has been sufficient to excite the contempt of some so-styled *savans* of repute. If knowledge be not in the range of the thoughts of certain severe cogitators, it is then, forsooth, no knowledge at all. The unmerciful contempt which has been cast on the divining rod—virgula divina, or baguette divinatoire—by certain cultivators of science, may be estimated by a reference to the earlier editions of a translation, by Dr. Hutton, of Montucla's improvement of Ozanam's Mathematical Recreations, a book full of most interesting matter. In the last edition of that work, however, Dr. Hutton proved himself to be, what he always was, a sincere lover of truth. Led into error at an earlier period, he was open to inquiry, and became, subsequently, convinced of facts on the existence of which he had at one time doubted. My friend, Mr. Charles Hutton Gregory, lent me a copy of the *Speculum Anni* for the year 1828, in which he pointed out some passages relating to this matter, which I cannot avoid extracting here, premising a few observations on the instrument called the divining rod, virgula divina, baculus divinatorius, baguette divinatoire. This has been supposed to be a branch of a tree or shrub necessarily of a forked or letter Y shape, by the assistance of which certain gifted persons were enabled to discover mines, springs of water under ground, hidden treasure, and to practise other occult doings. This, with regard to shape, is just as vulgar an error as that which supposes that a stick of any kind of wood held in the hand serves as well as the hazel or the whitethorn for the production of the phenomena. In the counties of Somerset, Devon, and Cornwall, the facts on this subject are well known, and the practice of dowsing, as it is called, has been cultivated time out of mind. In France the men of scientific pursuits have for the most part ridiculed the use of the baguette, notwithstanding abundant evidence in various parts of the country being extant of the success which had attended the practice of the sourciers. The Baron von Reichenbach has established facts regarding the emanations of light from graves, which are quite as remarkable as the proofs of emanations taking place from metals or from running water. Now that the Ba-

b. The force manifests its abode principally at the axes of the crystals, most actively at its opposite extremities: it therefore exhibits polarity.

ron's researches, and the concurrent testimony of the cultivators of mesmeric science, have established that certain individuals are more susceptible of magnetic impressions than others, it will not be pronounced *impossible* that subterraneous running water may influence some persons, and not others. In different classes of animals the sensitive powers are known to vary greatly, as they do indeed among those of the same species. "But," it has been asked, "granting that emanations from subterraneous waters may powerfully affect certain persons, what connection is there between this impression and the motion or rotation of the hazel rod, which is held in the person's hand or laid over his fingers?" What! is it fact that the hazel rod moves or rotates in the hand of a person of a certain impressionability, when that person passes over any ground, underneath his footsteps on which there happens to be a metallic lode, or a subterraneous stream of water, which we call a spring? I have been informed by highly respectable persons who have, in the West of England, witnessed the facts, that under these circumstances a hazel or a whitethorn rod does rotate and does move, and occasionally dips with so energetic a force, that on one occasion the bark of a fresh hazel rod was stripped from the stick and left in the grasp of the operator's hand.

The following extracts will further illustrate this subject:—

"Although the effects or motion of the divining rod, when in the proximity of springs, has been and is to this day considered by most philosophers a mere illusion, yet I think the following brief observations relating to this subject, and which were communicated to Dr. Hutton by a lady of rank, with the account of her subsequent experiments performed before him, his family, and a number of friends (as given in the doctor's translation of Montucla's edition of Ozanam's Recreations,) must convince the most incredulous that in the hands of some persons, in certain situations, the baguette is forcibly acted upon by some hitherto unknown invisible cause. Notwithstanding the incredulity expressed by Montucla relative to the indication of springs by the baguette or divining rod, there appears to exist such evidences of the reality of that motion as it seems next to impossible to be questioned. This evidence was brought about in the following manner. Soon after the publication of the former edition of the Recreations, the editor received by the post the following well-written pseudonymous letter on the subject of this problem. The letter in question is dated Feb. 10, 1805, and as with the whole of the correspondence it would be too long for our limits, I shall select such parts only as are immediately essential to a right understanding of the subject.

"The lady observes, 'In the year 1772, (I was then nineteen) I passed six months at Aix in Provence. I there heard the popular story of one of the fountains in that city having been discovered some generations before by a boy who always expressed an aversion from passing one particular spot, crying out *there was water*. This was held by myself and the family I was with, in utter contempt.

"'In the course of the spring, the family went to pass a week at the Chateau d'Ansonis, situated a few miles to the north of the Durance, a tract of country very mountainous, and where water was ill supplied. We found the Marquis d'Ansonis busied in erecting what might be termed a miniature aqueduct, to convey a spring the distance of half a league, or nearly as much, to his chateau, *c.* It emits light at the poles visible to acutely sensitive eyes in the dark.

which spring he asserted had been found out by a peasant, who made the discovery of water his occupation in that country, and maintained himself by it, and was known by the appellation of *l'Homme à la Baguette.* This account was received with unbelief, almost amounting to derision. The Marquis, piqued at being discredited, sent for the man, and requested we would witness the experiment. A large party of French and English accordingly attended. The man was quite a peasant in manners and appearance: he produced some twigs cut from a hazel, of different sizes and strength, only they were forked branches, and hazel was preferred, as forking more equally than most other trees; but it is not requisite that the angle should be of any particular number of degrees. He held the ends of the twigs between each fore finger and thumb, with the vertex pointing downwards. Standing where there was no water, the baguette remained motionless; walking gradually to the spot where the spring was *under ground,* the twig was sensibly affected; and as he approached the spot, began to *turn round;* that is, the vertex raised itself, and turned towards his body, and continued to turn till the point was vertical; it then again descended outwards, and continued to turn, describing a circle as long as he remained standing over the spring, or till one or both the branches were broken by the twisting, the ends being firmly grasped by the fingers and thumbs, and the hands kept stationary, so that the rotatory motion must of course twist them. After seeing him do this repeatedly, the whole party tried the baguette in succession, but without effect. I chanced to be the last. No sooner did I hold the twig as directed, than it began to move as with him, which startled me so much that I dropt it, and felt considerably agitated. I was, however, induced to resume the experiment, and found the effect perfect. I was then told it was no very unusual thing, many having that faculty, which, from what has since come to my knowledge, I have reason to believe is true. On my return to England I forbore to let this faculty, (or whatever you may term it,) be known, fearing to become the topic of conversation or discussion. But two years afterwards, being on a visit to a nobleman's house, Kimbolton, Huntingdonshire, and his lady lamenting that she was disappointed of building a dairy-house in a spot she particularly wished, because there was *no water* to be found—a supply she looked on as essential—under *promise of secrecy* I told her I would endeavor to find a spring. I accordingly procured some hazel twigs, and in the presence of herself and husband, walked over the ground proposed, till the twig turned with *considerable force.* A stake was immediately driven into the ground to mark the spot, which was not very distant from where they had before sunk. They then took me to another and distant building in the park, and desired me to try there: I found the baguette turn *very strong,* so that it soon twisted and broke: the gentleman persisted that there was no water there, unless at a great depth, the foundation being very deep, (a considerable stone cellar,) and that no water appeared when they dug for it. I could only reply that I knew no more than from the baguette turning, and that I had too little experience of its powers or certainty to answer for the truth of its indication. He then acknowledged that when that building was erected they were obliged to drive piles for the whole foundation, as they met with nothing but a quicksand. This induced him to dig in the spot I first directed; they met with a very fluent spring; the dairy was built, and it is at this time supplied by it. I could give a long detail of other trials I have made, all of which have been convincing of the truth. but they would be tedious. For some years past I have *d.* In particular diseases, it attracts the human hand to a peculiar kind of adhesion, like that of iron to the magnet.

e. It does not attract iron, does not cause any freely moving body

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been indifferent about its becoming known, and have consequently been frequently requested to show the experiment, which has often been done to persons of high estimation for understanding and knowledge, and I believe they have *all been convinced.* Three people I have met with, who have, on trying, found themselves possessed of the same faculty. I shall only add one more particular incident. Having once shown it to a party, we returned into the house to a room on the ground floor; I was again asked *how I held the twig;* taking one in my hand I found it turned immediately; on which an old lady, mother to the gentleman of the house, said *that room* was formed out of an old cloister, in which cloister was a *well*, simply boarded over when they made the room.

"'L'Homme à la Baguette, from experience, could with tolerable accuracy tell the depth at which the springs were, and their volume from the force with which the baguette turns; I can only give a rough guess. In strong *frost* I think its powers not so great; on a bridge or in a boat it has *no effect*, the water must be *under ground* to affect the baguette, and running through wooden pipes acts the same as a spring. I can neither make the baguette turn where there is *no water*, nor prevent it from turning where there is any, and I am perfectly ignorant *of the cause why it turns.* The only sensation I am conscious of is an emotion similar to that felt on being startled by sudden noise, or surprise of any kind.

"'I generally use a baguette about six inches from the vertex to the ends of the twigs where they are cut off.

"'I shall most probably be in London next winter, and will (if you wish it) afford you an opportunity of making your own observations on this curious fact.'

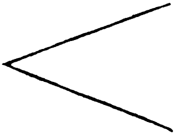
"The lady having arrived in London, wrote to Dr. Hutton to inform him that she proposed being at Woolwich on Friday the 30th inst. (May, 1806) at eleven in the forenoon.

"Accordingly," says Dr. H., "at the time appointed, the lady with all her family arrived at my house at Woolwich Common, where after preparing the rods, &c., they walked out to the grounds, accompanied by the individuals of my own family and some friends, when Lady —— showed the experiment several times in different places, holding the rods, &c. in the manner as described in her Ladyship's first letter above given. In the places where I had good reason to know that no water was to be found, the rod was always quiescent; but in other places, where I knew there was water below the surface, the rods turned slowly and regularly, in the manner above described, till the twigs twisted themselves off below her fingers, which were considerably indented by so forcibly holding the rods between them.

"All the company present stood close round the lady, with all eyes intently fixed on her hands and the rods, to watch if any particular motion might be made by the fingers; but in vain; nothing of the kind was perceived, and all the company could observe no cause or reason why the rods should move in the manner as they were seen to do. After the experiments were ended, every one of the company tried the rods in the same manner as they saw the lady had done, but without the least motion from any of them. And in my family, among ourselves, we have since then, several times, tried if we could possibly cause the rod to turn by means of any trick, or twisting of the fingers, held in the manner the lady did; but in vain, we had no power to accomplish it.

to assume directions referable to the terrestrial poles, does not affect the magnet, does not induce a galvanic current in wires, and consequently it is not a magnetism.

"The annexed figure represents the form and position of the rod, about six inches in length, cut off just below the joint or junction of the two twigs."



There can be no impropriety in stating now that the lady in question was the Honorable Lady Milbanke, wife of Sir Ralph Milbanke, Bart. (afterwards Noel) and mother of the present Dowager Lady Byron, the wife and widow of the great poet. A very interesting analogous statement relating to the same person will be found in the *Quarterly Review* for March, 1820: No. xliv. Vol. 22.

Lately in France, the Count de Tristan has published a work on the subject, which I have been unable to procure; but I have a most interesting volume containing two memoirs by M. Thouvenel, a physician of reputation in France, who was commissioned, in the year 1781, by the king, to analyze and report upon the mineral and medicinal waters of the kingdom. The author undertakes a patient and laborious investigation in the spirit of a philosopher, and regards his inquiries as leading to a new thread in the tangled skein of physics, which, like any single fact of science, may lead to the discovery of a thousand others; a fact which may have escaped the vigilant sagacity of observers, or which may have been totally abandoned to the blind credulity of worthy soft-headed persons, or in short, since the reign of a kind of false philosophy the offspring of scientific pride, may have been delivered over to the presumptuous disdain of men of false wisdom. Thouvenel found a man named Bléton, whose business was that of a sourcier, or discoverer of springs by means of a divining rod; and upon this man he made more than six hundred observations, many of them in the presence of above 150 persons, mostly of important stations, and very creditable from their high character, who testify to the truth of the observed phenomena. Among others was M. Jadelet, Professor of Physic at Nancy, a man eminent for his abilities, who was not only a witness of these experiments, but was actually concerned in the greatest part of them. As in the case of Lady Milbanke, with Bléton, an *internal feeling* was coincident with the movement of the rod. Whenever this man was in a place where there existed subterraneous waters, he was immediately sensible of a lively impression, referable to the diaphragm, which he called his "*commotion*." This was followed by a sense of oppression in the upper part of the chest; at the same time he felt a shock, with general tremor and chilliness, staggering of the legs, stiffness of the wrists with twitchings, a concentrated pulse, which gradually diminished. All these symptoms were more or less strong according to the volume and depth of the water, and they were more sensibly felt when Bléton *went in a direction against* the subterranean current, than where he followed *its course.* Stagnant water under ground did not affect him; nor did open sheets of water, ponds, lakes, or rivers affect him. The nervous system of this man must have been susceptible, since he was more sensibly affected by change of weather and variations in the state of the atmosphere than *f.* It may be charged and transferred upon other bodies by mere contact.

other persons; otherwise he appeared healthy. A severe acute disorder had absolutely at one time deprived him of the faculty of perceiving water, and his sensibility in this respect did not return until three months after his recovery; so that if he were sensitive, he could not be classed among the *sick sensitive.* But however remarkable these constitutional peculiarities may have been, there was in Bléton's case a more than usual distinctness in the behavior of the divining rod. Unlike many sourciers, he did not grasp it closely; he did not warm it in his hands; he did not prefer a young hard branch forked, newly plucked, and full of sap. His custom was to place horizontally on his forefinger and thumb a rod of any kind of wood (except elder), fresh or dry, not forked, only a little curved or bent. A very straight rod failed to turn on its axis, but a bent rod turned on its axis, with more or less rapidity, according to the quantity of the water and the force of the current. Thouvenel counted from thirty-five to eighty revolutions in a minute, and always noted an exact proportion between the rotation of the rod and the convulsive motions of Bléton. If these memoirs be critically examined, it will be found that the author experimented with full care to avoid every source of fallacy. The natural motions of the rod on Bléton's fingers was backwards, but as soon as he withdrew from the spring over which he stood, in any direction whatever, the rod, which instantly ceased to turn, was subject to a new law, for at a determinate distance from the spring an action of rotation in a direction contrary to the former one took place. This was invariable, and upon measuring the distance of the spot, where this retrograde phenomenon took place, from the spring, its depth could generally be found.

I pass over an account of numerous experiments made by this intelligent and careful observer, pointing out the analogies of the known phenomena of electricity and magnetism, by modifications resulting to the sensibility of Bléton, and the rotation of the rod by various ingenious electrical and magnetic trials suggested by the inventive sagacity of Thouvenel, in order to arrive at the curious anticipations of some of Professor Faraday's discoveries, by means of the sensibility of Bléton and the invariable laws which regulated the rotation of the divining rod, when the experiments were made over places where various substances had been concealed under the ground. It was found that whether the trials were made in this manner or over masses of coal, subterraneous currents of water, or metallic veins, the divining rod indicated a determined sphere of electric activity, and was in fact an electrometrical rod. "Of all the phenomena relating to the distinctions of fossil bodies," says Thouvenel, "acting by their electric emanations, doubtless the most surprising is this; upon the mines of iron, of whatever kind they may be, the rods supported by the fingers of Bléton turned constantly upon their axis, from behind forward, as upon the mines of coal; while upon other metallic mines, as upon other metals extracted from their mines, the rotary movement took place in the contrary direction, that is to say, from before backwards. This circular movement, which never varies while Bléton is in a perpendicular position over mines or upon metals, presents revolutions as rapid and as regular as the revolutions in the contrary direction upon the mines of iron and of coal."

The constitutional effects of spasms and convulsive twitchings took place more or less in all the veins, but copper emanations excited very strong and disagreeable spasmodic symptoms, accompanied by pains about the heart, by flatulent movements in the bowels, and by abundant eructations of air. On lead, there *g.* Matter possesses a certain coercive power over it, but only for a limited time, during which the transferred force disappears.

seemed to be less unpleasant consequences, but stronger again on the mines of antimony. Having previously determined that for Bléton, on all the metals, except iron, there existed a sphere of electric activity, which propagated itself towards the west, a great number of experiments were made which always had the same results. At the depth of two, three, or four feet under ground were buried gold, silver, copper, tin, lead, and iron. The weight of each was only from five to eight pounds. In other similar pits pyrites of all kinds, sulphur, coal, resin, wax, and lard, were buried. All these different deposits were made at distances from each other, in gardens or in open country, and they were so well covered over and concealed that nothing could be perceived except private marks to be known only to certain assistants. Over the resin, wax, and lard, Bléton experienced nothing; over the coal there was a decided effect; the convulsive tremor of muscle was manifest, and the rod rotated from behind forwards. Over the iron the same indications, but more energetic. A feeble impression from the sulphur, but sufficient to establish a difference between it and the two preceding, and the rod over the sulphur turned from before backward. Pyrites produced the same rotation as the sulphur, and a slight tendency of the electric sphere towards the west. Gold and copper especially exhibited strongly this singular tendency of the active electric emanations. Over silver, tin, and lead also, it was more remarkable. It extends itself more or less from the focus of the metals, according to their depth and their mass. For example, in describing a circle having a radius of three or four feet from this focus, Bléton felt absolutely no action except on the line of the west. It was the same when, in proceeding from the vertical point of the focus, he successively traversed all the radii of the circle; or even if he went from all the points of the circumference to proceed to the centre. In these two inverse proceedings it was always only on the radii going westward that his person and the rods were affected by movements more or less intense, according to the kinds of metal.

It must, however, be admitted that the action of these metals presenting only the differences of greater or less in degree, either in the nervous and muscular impressions of the body, or in the circular revolutions of the rods, constantly moved from before backward, these differences do not yield a certain means of distinguishing the five metals one from the other. The object Thouvenel had in view was nevertheless fulfilled, for he had established the extent and the determination of a sphere of electric activity towards the west, in certain metals and on sulphur, which does not exist in the same manner on iron, on coal, or on streams of water.

To give a summary, then, of the relations of these phenomena to those established by Professor Faraday, it may be said that over iron mines the divining rod assumes a movement of rotation diametrically opposite to that which it exhibits over all other mines. When iron and other metals are extracted from their ores and deposited under ground, the phenomenon occurs with the same distinction; that is to say, with iron it rotates towards the north. With all the other metals submitted to trial, its action is from east to west. The influence of the red metals appears to be more energetic than that of the white. But with regard to this divining rod let one condition be remarked—the relation of the organic substance to another organic and living power of matter; to a human being in a certain susceptible state of nervous system. Thouvenel describes the symptoms which affected Bléton when he was in the sphere of metallic action, and the rod becomes *h.* Matter has a power of conducting it, in different degrees, in proportion to the continuity of bodies.

the secondary part of the philosophical instrument, composed of an impressionable human being and a piece of stick. Some of the Baron von Reichenbach's subjects would have been just the persons to illustrate the facts of Blétonism.

A highly susceptible girl, the lady's maid of a very clever and intelligent friend of mine, residing in Hertfordshire, offers, when she is mesmerized, a great many deeply interesting phenomena. I have repeatedly mentioned her to Harriet P——. She is as guileless and as good a being as can be met with, and is much beloved by her excellent and amiable mistress, who has repeatedly addressed me on her case. If a piece of hazel stick or whitethorn be presented to Harriet, she grasps it and sleeps mesmerically in less than a minute. The sleep is at first very intense and deep, and then the stick is held so firmly that the spasmodic state of the muscles renders it very difficult for even a powerful bystander to turn it in her hand. Mary Anne Douglas and several others of my patients have exhibited the same phenomena. In two of the cases a very curious point has been remarked. If the hazel or whitethorn stick be held with the pointed end upwards, that end which is upwards when it grows from the ground, a force of attraction is so energetic that these individuals cannot resist their inclination to grasp it with both hands. One of them will rush towards it from a considerable distance, and will with extreme eagerness run from the bottom to the top of the house in order to have the pleasure of grasping it. If she succeed in getting hold of it before its direction is reversed, her delight is unbounded; she becomes intoxicated, and soon passes into a state of deep unconscious sleep. If, however, the stick be turned rapidly with its pointed end downwards, a repulsive force operates, and each patient feels a repugnance to it. If the stick be allowed to be held in both hands, and a piece of gold, or of platinum, or of cobalt, or of nickel, or the pointed end of a rock crystal be held to it, in each experiment there is a burning sensation complained of, and an endeavor is made to loosen the hold on the stick, with ludicrous haste. A gentleman who had been often put into mesmeric sleep, remarked, on holding successively several pieces of these sticks, that a sensation of heat was communicated to his hand in each instance, and he felt a strong tendency to sleep. Susan L——, a highly susceptible person, exclaimed, while in a sleep-waking state, "that a shower of fine small sparks of fire" came from a piece of hazel which happened to be in my hand. She did not see this from ash or from fir, but invariably saw it from every piece of hazel or from whitethorn that was brought near her. On numerous occasions experiments were made to test the accuracy of her repetitions on observing these things, and she invariably gave the same answers to the questions on the same objects. Subsequently, eight other individuals were separately examined as to their susceptibilities to different kinds of wood. Each gave the same results and saw the sparks of fire. In many other cases, the impressionability being different, the hazel and whitethorn had no perceptible effects; the patients handling the bits of stick without observing heat or sparks, and failing to grasp them spasmodically. But Harriet P——r's impressionability was put to a very useful purpose. Her mistress had heard of the practice of dowsing for water, and in a letter to a correspondent, now before me, writes thus under date of July, 1845:—"We made a curious experiment here some days since with Harriet P——. We have very bad water here, and have long been unable to find a good spring. Mr. G. has in vain dug and dug and dug for one. I proposed the divining rod; for, said I, Dr. Ashburner would

i. The capacity of bodies to receive a charge is in direct relation to the strength of the crystallic force.

not think it a foolish experiment. Harriet P. was willing, so we went forth to a field the most likely one for a spring; Mr. and Mrs. G., myself, and two friends staying here. We put Harriet to sleep by the hazel stick; she grasped it so tightly we were obliged to use the gold chain;—she then held it only in one hand, and immediately began to walk, taking her own way. She went very carefully for about twenty yards; then suddenly stopped as if she had been shot. Not a word was uttered by any one. We all looked on, and were not a little surprised to see the rod slowly turn round until her hand was almost twisted backwards. It looked as if it must pain her. Still no one spoke. Suddenly she exclaimed, 'There! there! don't you see the stick turn? the water is here—under my hand. I see, oh I see—let me look—don't speak to me—I like to look.' 'How deep is the water?' said Mrs. G., speaking to Harriet's fingers. 'Oh, about three feet; I can't quite tell, but it is here.' In a moment, to our astonishment, she sunk down on the grass, took the stick again in both her hands, and seemed to like it as if it could feel. We made a strange group round her, as we were all much astonished to see what we had come there to see, but still it astonished us: she seemed so like a little witch. We marked the place, and after a few minutes we awoke her. In the evening she was again mesmerized to sleep, and we asked her what she saw at the spring. 'Why I saw water—water everywhere.' 'Then,' said I, 'how do you know where the spring is?' 'Oh, because it goes trinkle, trinkle—I know it is there.' 'Why did you sit down?' 'Why, because I was so giddy: it seemed as if all was water but the little piece of ground I stood upon;—oh I saw so much water, all fresh, but no sea; I tried to see the sea, but I could not—I could not at all.' Mr. G. caused a large hole to be dug at the place; and just at the depth of three feet the water was found. A brick well has been constructed, and there is a good supply of excellent water. No one could doubt of the action of the rod, it turned so evidently *of itself* in her hand. Of course when awake Harriet knew nothing of the circumstance."

So many and so various are the testimonies and the facts relating to the divining rod, that it would be tedious to recite the hundreds of respectable documents offered by those authors who have written on this subject. Lately, a work by Tardy de Montravel, printed in 1781, entitled "Mémoire Physique et Medicinale sur la Baguette Divinatoire," has fallen into my hands, and it abounds in testimonies as to the truth of the same class of facts. One of the most curious works I have seen on the subject is a little book with the title of "La Physique occulte, ou Traité de la Baguette Divinatoire, et de son Utilité pour la découverte des sources d'eaux, des minieres, des trésors cachez, des voleurs, et des meurtriers fugitifs, avec des principes qui expliquent les phenomènes les plus obscurs de la Nature," par M. L. L. de Vallemont, Ph. D. et Ph., &c. This work, embellished with plates illustrating the different kinds of divining rods, with the various modes of holding them for use, appeared at the latter part of the seventeenth century, and passed through several editions in France as well as in Holland. It is remarkable for much curious literary and historical learning, and for able statements of the arguments which were used in the controversies, rife at that period, on the realities of the facts under consideration. It contains a curious catalogue of a great number of mines discovered, in France, by means of the divining rod, made out by a German mineralogist employed for the purpose by the Cardinal de Richelieu. But the most singular part of the book is the power-

k. It expresses itself quantitatively different at the two poles; so that, like the magnet, it produces, as a rule, sensations of cold at the

fully authenticated history of Jacques Aymar, a peasant, who, constitutionally impressionable, guided by the divining rod, followed a murderer for more than forty-five leagues on land, and more than thirty leagues by sea:—

On the 5th of July, 1692, a dealer in wine and his wife, residing at Lyons, were murdered in a cellar, for the sake of robbing them of a sum of money kept in a shop hard by, which was at the same time their chamber. All this was executed with such promptitude and secrecy that no one had witnessed the crime, and the assassins escaped.

A neighbor, struck with horror at the enormity of the crime, having remembered that he knew a man named Jacques Aymar, a wealthy peasant who could follow the track of thieves and murderers, induced him to come to Lyons, and introduced him to the king's attorney-general. This peasant assured the functionary that if they would lead him to the place where the murder was committed, in order that he might receive from it a certain influence, he would assuredly trace the steps of the guilty parties, and would point them out wherever they were. He added, that for his purpose he should make use of a rod of wood such as he was in the habit of using to find springs of water, metals, and hidden treasure. The man was conducted to the cellar where the murders were committed. There he was seized with emotion; his pulse rose as if he were suffering from a violent fever, and the forked rod which he held in his hands turned rapidly over the two places where the murdered bodies had lain.

Having received the impression, Aymar, guided by his rod, passed through the streets through which the assassins had fled. He entered the court-yard of the archbishop's palace. Arriving at the gate of the Rône, which was shut, it being night, he could then proceed no further. The next day he went out of the town by the bridge of the Rône, and always guided by the rod, he went to the right along the bank of the river. Three persons, who accompanied him, were witnesses that he sometimes recognised the tracks of three accomplices, and that sometimes he found only two. In this uncertainty, he was led by the rod to the house of a gardener, where he was enlightened as to the number of the criminals. For on his arrival he maintained that they had touched a table, and that of three bottles which were in the room they had touched one, over which the rod visibly rotated. In short, two boys of nine and ten years of age, who, fearing their father's anger, had at first denied the fact, at last acknowledged that three men, whom they described, had entered the house, and had drunk the wine which was contained in the bottles indicated by the peasant. As they were assured by the declaration of the children, they did not hesitate to go forward with Aymar, half a league lower than the bridge on the bank of the Rhone. All along the bank for this distance the footsteps of the criminals were traced. Then they must have entered a boat. Aymar followed in another on their track as clearly by water as by land; and his boat was made to go through an arch of the bridge of Vienna which is never used, upon which it was concluded that these wretches had no boatman, since they wandered out of their way.

On the voyage, Aymar went ashore at all the places where the fugitives had landed, went straight to their coverts, and recognised, to the great surprise of the hosts and spectators, the beds on which they had slept, the tables on which they had eaten, and the pots and glasses they had touched.

He arrived at the camp of Sablon, where he was considerably agitated. He pole corresponding to $-M$, at the pole corresponding to $+M$ of gentle heat. In regard to quantity the northward pole is stronger, the southward pole weaker.

believed that in the crowd of soldiers he should find the murderers. Lest the soldiers should ill-treat him, he feared to operate with his rod. He returned to Lyons, whence they made him go back to the camp of Sablon by water, having furnished him with letters of recommendation. The criminals were no longer to be found there. He followed them to the fair of Beaucaire in Languedoc, and always remarked in his course the beds, the tables, the seats where they had been.

At Beaucaire the rod conducted him to the gate of a prison, where he was positive one of the wretches would be found. Fourteen of the prisoners were paraded before him, and the rod turned on a man with a humped back, who had been sent to the prison about one hour before for a petty larceny. The peasant did not hesitate to declare his conviction that the hump-backed man was one of the assassins; but he continued to search for the others, and found that they had gone towards Nismes. No more was done at that time. They transferred the hump-backed man to Lyons. On the journey he asseverated his innocence; but finding that all the hosts at whose inns he had lodged recognised him, he avowed that he had been the servant of two men of Provence who had engaged him to join them in this foul deed: that these men had committed the murder and had taken the money, giving him but six crowns and a half from their booty of one hundred and thirty crowns. He corroborated the accuracy of the indications of the peasant as to the gardener's house, the camp of the Sablon, the fair of Beaucaire, and the other places through which the three had passed, extending over forty-five French leagues. All these things of course excited immense interest. At Lyons many repetitions of the observations respecting the turning of the rod in the cellar were made in presence of many persons. Monsieur l'Abbé Bignou gives his testimony to the truth of the statement of facts, in a letter, inserted by Vallemont in his work. There can be no doubt that such statements require very strong corroboration, and here they apparently obtain it. Vallemont, quoting the authority of the Royal Society of London, in the second part of the history, seventeenth section, one hundred and twenty-fifth page, says, that in all countries where men are governed by laws, the testimony in a matter of life and death, of only two or three witnesses, is required; but is it, then, treating an affair of physics equitably, when the concurrence of sixty or a hundred persons is insufficient? It is difficult to define the just boundaries of credulity; but in all these recitals of histories of events, there is this general consent, that in those who can make use of the rod, there is always an agitation, a fever, or some sensation which indicates a nervous commotion; and the best evidence of the closest investigation goes to the point that most frequently the rod is of hazel wood. How far these stories tend to the conclusion that organic tests appear to require the re-agencies of organic force is at present a matter of speculation; but it is to be hoped that the effort to attract serious attention to this class of facts is not uninteresting or unimportant.

There are many facts connected with the Baron's new force which may be used to illustrate the influence of water and of shining surfaces in producing the clonic spasms of hydrophobia. The phenomena offered by certain somnambules are highly illustrative of the effects of water in certain diseased or susceptible states of the human system. Running water, a constantly changing series of crystalline molecules, perpetually discharges positive or negative odic force.

l. Warming the crystal has hitherto produced no essential modification.

m. This force of crystals is contained in those exhibited by the magnet; it constitutes therefore a separable part of them, capable of being isolated.

THIRD TREATISE.

EXPERIMENTS TO ESTABLISH SOME FIXED PHYSICAL LAWS IN THE VARYING PHENOMENA WHICH HAVE HITHERTO BEEN CALLED ANIMAL MAGNETISM.

58. In the first place I shall endeavor to apply the laws obtained in the two preceding treatises to another series of investigations which have reference here, and to give them a wider extension and better foundation. Beyond the memory of man, have been known certain enigmatical phenomena, produced by the magnet, in its effect on many sick persons, especially on somnambulists. In the last century, and indeed earlier, it was found that similar phenomena might be brought about by bare hands, and without a magnet. In the condition, up to this time, of our physical knowledge, it was impossible to discover any certain connection between that force of the magnet, and this of the human hands, feet, &c., and equally in vain was it attempted to detect any regularity and subjection to law. The consequence of this was, that all those who were occupied with natural science passed by these subjects, and gave them no place in the school of physics. Isolated physicians and dilettante kept alive the tradition, or increased the heap of unconnected observations. For want of a better word, they called it *animal magnetism*—an expression which is the more unsuitable, the less the phenomena signified by it agree with that which constitutes magnetism in the proper sense of the word. In the meantime, books have been written; few are good, many appear altogether one-sided, many are actually unreadable.

At first I avoided entering upon this literature; I wished to retain my powers of observation and judgment free and unbiassed, and to build my work from the beginning solely on the foundation of my own experience. It seemed to me better to select my own path in the direction in which natural science usually advances, and which is never that of medicine. The medical man is chiefly concerned for a remedial agent, but the physicist looks solely for natural truths; one seeks the concrete, the other the abstract, and it is from this primary divergence that the two have hitherto been able to combine so little in their researches.

59. After I had demonstrated a force in crystals, which, with all its difference, at the same time bears an unmistakeable analogy to magnetism; while the so-called animal magnetism, appearing in a shape similar to the former, on the other hand, allows us to perceive in certain resemblances an astonishing parallelism with magnetism, in spite of particular essential differences; this affinity of the conditions led me to the inquiries—whether and how much might be found to be common to all the phenomena, and whether at last some laws might not be discovered, upon which animal magnetism might rest, in the same way as the crystallic force. Since we imagine crystallization to be the connecting link between the inorganic and organic, the dead and the living, I believed I might encourage some hope finally to obtain, by way of experiment, a point of connection between animal magnetism and physics—perhaps even to procure it a resting-place for which it has hitherto striven in vain.

60. To open a path to this, it seemed to me above all things necessary to make out, as clearly as possible, the part which the terrestrial magnetism plays in these matters. Since the magnet, since the crystallic force, exercises so decided an influence on sensitive persons, the power of the terrestrial magnetism, which directs the magnetic needle, cannot be without influence on the animal nerves. And I thus saw clearly that it was impossible to draw any scientific conclusion from any experiments, so long as this powerful factor, which must always interfere in the phenomena, was not considered, measured, and brought into the account.

With this view I now tested both healthy and sick, in particular Mr. Schuh, Mr. Schmidt the surgeon, and Misses Nowotny, Sturmann, Maix, Reichel, Atzmannsdorfer, and others, under different circumstances and at different times.

61. Mr. Schuh, in his present dwelling, had the strange custom of regularly turning round in bed, when he woke early in the morning; that is, he then placed his head where his feet had been during the night, after which he always went to sleep again. This sleep was always more refreshing than all the preceding night's sleep, contrary to the general rule, according to which, the earlier sleep, especially that before midnight, is the most strengthening. When he had not this after-sleep, he felt weaker all day: and thus this strange custom had for a long time been a necessity to him. I inquired about the position of the bed, and learned that the head was turned toward the south, and the foot toward the north. By my advice he assumed the opposite position when he went to bed at night; that is, with the

head to the north and the feet to the south. From this day forward he never found the morning after-sleep necessary; the sleep was good, and strengthening; and he thenceforward gave up that custom.

62. Mr. Schmidt, the surgeon, of Vienna, had received a chill of the right arm on a railway journey, and for some time had suffered from acute rheumatism, with the most painful cramps running from the shoulder to the fingers. His physician treated him with the magnet, which rapidly quieted the cramps, but they always returned. I found him lying with his head directed toward the south. On my remarking this, they turned him round and brought him into the direction of the magnetic meridian, with his head to the north. Directly he came into this position he uttered expressions of pleasure; he declared that he felt refreshed and strengthened. A pleasant uniform warmth diffused itself forthwith in the chilled part,—he felt the pass of the magnet incomparably more cooling and agreeable than before, and before I went away the stiffened arm and the fingers became moveable, and the pain had wholly disappeared.

63. When I tried the position of Miss Nowotny with the magnetic needle, I found her almost exactly in the magnetic meridian—the head lying to the north. She had herself instinctively sought and wished for this direction, and it had been necessary to break down a stove to satisfy her desire. I asked her to lie with her head to the south, by way of experiment, to ascertain the result. It required some pains to induce her to do it, for I was obliged to repeat my wish three or four days running, and to make her appreciate the weight I laid upon this change, before I brought her to it. At length I found her one morning in this reversed position; she had assumed it a short time before my arrival. A very little time elapsed before the patient began to complain. She was uncomfortable; she turned over restlessly; her face became flushed; her pulse rose, became fuller; flow of blood to the head increased the headache; and discomfort of the stomach soon ensued. The bedstead, with the patient, was quickly turned round again, but stopped when moved a quarter of a circle. She now lay in the magnetic parallel, with her head to the west. This direction was completely unbearable to her, and still more adverse than the south-north position she had just left. This was at half-past ten A. M.. She feared from her sensations, that if she remained she would soon faint, and begged to be quickly removed from this situation. She was then brought back into her original north and south direction. Immediately after this all the adverse conditions decreased, and in a few minutes had disappeared so perfectly that the patient became cheerful again. But not merely an

extreme discomfort seized the patient in the altered direction toward the heavens,—her reactionary sensations to all external things were transformed in the most striking manner. The usual passes of the magnet, performed by her physician, which she always found agreeable, then became unpleasant,—stronger ones intolerable; substances at other times disagreeable, like sulphur, were then almst indifferent; others, such as lead, even agreeable; in short, all diseased conditions assumed an altered form.

These observations were too full of import, and held out too great a prospect of immediate value for medical purposes, to be passed over without farther and more careful investigation. I concerted, therefore, with her physician for a farther inquiry on a future day. This took place on the 4th of April, 1844. When we came to the patient in the morning, we found that she had already been lying half an hour in the south-north position. She anxiously longed for our coming, and earnestly begged to be speedily released from her painful situation. All the above-mentioned phenomena were repeated in the same order of succession; her hand no longer followed the magnet, but was only weakly attracted by it—even the strongest did not produce any spasmodic clenching of the hand, and the reactions to different substances were disturbed just in the same way as before. In order to enable us to trace all these things conveniently by experiments, we had the patient dressed, and taken out of bed. I now placed her alternately on four chairs, which I had arranged in a square in the N.S., S.N., E.W., and W.E. positions, the feet being extended, the head thrown back, so that her position was half reclining. The *north-south* position was, as before, comfortable and pleasant; the *south-north* furnished, step by step, the same results as in the two preceding trials; they followed gradually, one after another, in the course of about half an hour. But when the patient was brought into the *west-east* position, the phenomena presented themselves most distinctly, and so rapidly, that this position could scarcely be endured for a minute. The effect of the magnet on the senses ceased almost wholly at once; at the moment of entrance into the position, disagreeable heat came over her; then quickly followed, in order, an universal external and internal shivering, disquiet, flushing, acceleration of the pulse, determination of blood to the head, headache; finally, pain in the stomach, hummings in the ears, loss of sense, and approaching syncope. It was necessary to hasten to bring her back into the north-south position, unless we would run the risk of seeing her fall from the chair. The rapid disappearance of all these adverse symptoms after her return to the latter position was astonishing; in a few minutes her face became cheerful again, although it had just before expressed the most distressing sensations. After some interval of rest, we tried the *east-west*. I held my watch in my hand, and found that not more than a minute had elapsed before all the phenomena appeared in the same way and in the same order as they had in the west-east position, only somewhat milder. For the greater confirmation and more accurate observation of all these occurrences, the experiments were finally repeated, as we induced the patient to place herself once more in each of the different directions; the result was just the same.

Since Miss Nowotny's sickness had been protracted, slowly increasing, for eight years, I asked whether she had not observed, while the disease was in its milder stages, that she had felt more or less comfortable in different places. Inquiry was made, and it was remembered that in some of the houses in which she had resided during that interval, her condition had been either more quiet or more strikingly insupportable. I gave her brother a compass, and bade him see in what positions her bedstead, sofas, or working-seats had been placed in the various former residences. He actually found that in the Wohl-leben Street, her bedstead and sofa had accidentally been placed almost exactly in the magnetic meridian, and she herself had lain in the north-south position; while in the Marokaner Street her direction had been north-eastward and south-westward. In the Wohl-leben Street she had been comparatively easy, while in the Marokaner Street she had never been well, but had constantly struggled with the most painful illness. Even now, she knew not why, she could never bear to sit either across the bed, nor on her couch, nor yet to lie down on the latter: she could only remain lying in bed. The first brought her into the west-east position, the second into the east-west, the third into the south-north, and the fourth alone insured to her the indispensable north-south direction.

As between north and south, so also between east and west, a not inconsiderable distinction was subsequently discovered. In June, namely, when she was already so much improved that she could sit up the greater part of the day, I tried her once more in the four positions. She could now remain for a good while in the south-north position; in the east-west also she was tolerably well for a little time; but in the west-east position she could not remain more than a minute without feeling the attacks, even to the irritation of the stomach. A few minutes' rest in the north-south direction wholly removed the evil effects of the few minutes in the west-east position. *The west-east position was therefore by far the worst and most exciting of all.* I add the remark, in reference to the position of the sun and terrestrial thermo-magnetism, that this last experiment was made about five o'clock in the afternoon.

64. Furnished with these experiences, I visited the sick Miss Sturmann at the hospital of the Vienna University. She was suffering from tubercle of the lungs, and they called her condition *eklampsia.*[*] According to her account, her illness had commenced about three years previously, when she was in her sixteenth year, after dancing very violently at several balls. I found her lying in a bed, in the west-east position. I tried a very strong magnet upon her, one which would support 50 lbs.; I passed it over her, laid it upon her head, and under her feet. It produced some weak reactions, but of little importance. I then asked her physician, Professor Lippich, to allow her bed to be moved into the north-south position of the magnetic meridian, which he was kind enough to order. In a moment everything changed. The patient immediately evinced pleasure; her former disquiet left her; a painful burning of the eyes, which she had suffered unceasingly, disappeared; instead of the previous insufferable heat, she felt only a comfortable coolness, and a general relief was visible. A night of unusually peaceful sleep followed, such as she had not experienced for a long time. Her bed was now kept permanently in this position, as she herself also earnestly requested. Another time I induced her to turn round in bed, and thus brought her into the south-north position; just as quickly as everything had turned to good before, all now returned again to evil; general disquiet and heat ensued, flushing of the face, determination to the head, followed, and the peculiar *burning in the eyes* at once reappeared. All this was removed again as soon as I allowed her to return to her north-south position. Now, when she was in the normal direction, I again took up the magnet. But what a difference! She, who could scarcely feel it before, could not bear it now, when I removed the armature at a considerable distance from her. I placed myself with it at a distance of four paces from her head; the patient gave me no answer, and when I examined her I found her in a state of unconsciousness, in tonic spasms. After her recovery from this, I took my place seven paces from the foot of her bed, and removed the armature: and here also she had scarcely spoken a word, before she became senseless, and fell into the same condition. A third time I removed, in the prolonged direction of the magnetic meridian, the

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[*] Convulsive movements of the eyes, of the muscles of the abdomen, and of the extremities, now and then with pain, and sometimes with tendency to a deep unhealthy sleep; a description of case easily and completely curable by continued mesmerism.

whole length of the ward, which amounted to more than thirty feet from her bedstead and her feet. Not quite so quickly as before, she felt the magnet in some degree after I had removed the armature; but after I had remained about a minute in this position, she stopped speaking in the middle of a word that was upon her tongue. She had half said it, the rest died away on her lips. She had been suddenly attacked, and I found her lying rigid with spasms, and with clenched hands, her eyes open and cast upward, so unconscious that I could place my finger on her eyeballs without the lids moving. What an unexpected difference in the effect! The same magnet which I had placed above her head and under her feet without any remarkable effect, so long as she lay in the magnetic parallel, now, when she was in the meridian, threw her into a state of unconsciousness at a distance of ten yards! at a distance of thirty feet attacked her in a deadly manner.*

65. Miss Maix, unable to walk, was kind enough to grant my request of allowing herself to be moved in a chair into the four directions. She is neither cataleptic nor somnambulist; never was so, but suffers from paralysis of the lower part of her body. In spite, therefore, of the cases being of totally different kinds in these sensitive patients, I nevertheless obtained exactly similar results here; the patient could only bear the north-south direction, and the west-east was the most insupportable. This experiment was not performed in the morning, as with Miss Nowotny, but about four o'clock in the afternoon.

66. In Miss Reichel's case, the physician took no notice of the position in regard to the heavens, and when I remarked about this to him, he said he thought the patient strong enough to be indifferent to its effects. I was not of the same opinion, and when I tested the patient, and made her occupy the four chairs, one after another, as great a difference presented itself as in most of the other sensitive patients. Finding her bed in the south-north position, I counselled her to have it moved into the north-south. She followed my advice,

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* If the Baron had accustomed himself to mesmeric experiments, he would have discovered that the magnet, in this case, had induced that kind of tonic spasm which constituted a true mesmeric deep sleep, from which the application of unmagnetized iron to the nape of the neck, the magnet being removed to a suitable distance, would have roused her up. Instead of any fear of the "deadly manner" of the magnet's action, the probabilities are that the frequent and prolonged exercise of the magnetic or mesmeric practice, the rigid spasms being repeatedly produced, the eclampsia would speedily have vanished, and health would have been restored. The worthy and talented Baron has operated with mesmeric patients, while he has deprecated the use of these in his researches.

and found her night's rest much improved; now she could sleep, which had been extremely difficult before.

67. With Miss Atzmannsdorfer I tried the experiment at two different hours; once in the morning, when her illness was on the increase, the other time in the evening, in her recovery. In both cases the north-south position was the easiest, the west-east the most insupportable.

68. All these patients now recalled to mind how uncomfortable they always were in church, although they knew not the reason why. Catholic churches are all built from west to east, so that the congregation before the altar are in the west-east position; therefore in that direction which is the most insupportable to the sensitive. In this situation, therefore, they all often fainted, and were obliged to be carried out of the church. Miss Nowotny subsequently could not bear to walk in the garden or in the streets from west to east, for any length of time.

69. These eight completely different cases all agreed in this point, —that for sensitive persons of the most varied kind, any other position but that with the head to the north and the feet to the south is in the highest degree uncomfortable, but the position in the parallel, with the head to the west in our northern hemisphere, is almost insufferable: perhaps the conditions are different in the southern hemisphere. The causes of these phenomena, as is seen at a glance, can only lie in the effect of that magnet, which is constituted by the terrestrial globe and its atmosphere; in other words, of the terrestrial magnetism. It here affects just like any other magnet, and from the present investigation we arrive at a law, which I will comprise in the following terms:—*The terrestrial magnetism exercises in sensitive persons, healthy and sick, a peculiar exciting action, strong enough to interfere with their rest; in the healthy, to modify their sleep; in the sick, to disturb the circulation of the blood, the functions of the nerves, and the equilibrium of the vital force.*

70. And since the magnetic conditions of the earth are subject to variations, and these variations are connected with the *phases of the moon*, among other things, in such a way that, as is well known, the intensity of the terrestrial magnetism in relation to that, attains its minimum when the moon is full; here evidently emerges from obscurity one of the causes to which the phenomena of *somnambulism* (*mondsucht*) *are to be attributed.* I cannot express myself on this until I have advanced to some more special developments.

71. If, then, terrestrial magnetism thus displays itself as a wonderfully powerful re-agent upon our bodily condition, and more or less upon our health in general, its action in the eight investigated

cases being so great, that it to a great extent determined the healthy and sick condition, we are certainly justified—nay, compelled—to reason from these to other cases of sensitive disease, and must recognise that in many, perhaps all these cases, it will be impossible to effect cure by means of magnetism, when the patient is not first of all placed in the proper position towards the terrestrial magnetism: that this must, before all things, be sought out and borne in mind in all kinds of curative treatment, and that all magnetic phenomena in nervous patients—nay, perhaps in many other diseases—are greatly influenced by it. It furnishes the key to a vast number of errors and contradictions, which have presented themselves throughout the field of animal magnetism, from the time of Paracelsus and Mesmer to our own days, which were a stumbling-block to the best thinkers, and have everywhere brought contradiction into the facts and discord into opinions. For, when one and the same disease was treated in Vienna in the north-south position, in Berlin in the east-west, and at Stuttgart in the south-north, different results were obtained in each case: no agreement could be arrived at in the experiments. Nay, even when the same physician treats exactly the same complaint at different times, or simultaneously, but in different places, with the same magnetic means, if the beds of his patients happen accidentally to be placed in different directions, he necessarily will find effects produced differing as widely as possible from each other: he must be led away, and be wholly mistaken about magnetism: he must consider it full of caprice, and from the impossibility of foreseeing and regulating the results, at length throw it aside as an intractable and unmanageable instrument. This, therefore, has been the melancholy history of magnetism. During ages, repeatedly taken up and laid aside again, now lies, almost unused, so remarkable, so profoundly efficient—nay, one may say, an imcomparable means of allaying suffering, where the human hand is so seldom capable of affording help. Physicians themselves call nervous diseases the *scandala medicorum.* At a not far distant time I confidently hope this will not be. Henceforth the all-powerful influence of terrestrial magnetism will be estimated and taken into account, and the whole question of magnetism will be subjected to regular study in its relation to medicine; progress will be made, and a clear understanding arrived at. The world will at length be able to hope for healing powers to be drawn from these extraordinary things, whence it has so long justly expected them. If any physician have here and there remarked, that his patients generally found themselves better in a position where the head was directed to any particular point of the compass, the matter, so far as I know, has never been reasoned upon to any extent; least of all, has its peculiar and mighty import been educed, or been traced back to its physical basis. Here, however, where I have merely to do with the relations of the subject to physics, beyond the limits of which it would be beside my purpose to stray, I have merely to remark, in reference to § 60, that after I had established by the foregoing experiments, the powerful co-operation of terrestrial magnetism in the magnetic influences upon sensitive persons, *I made all the succeeding investigations with them solely in the magnetic north-south position, and that I regard this as the normal direction for all re-actions on living, sensitive, nervously diseased human bodies.*

72. Now that by the researches from § 60 to this point, we have arrived at the theoretically and practically important fact, that terrestrial magnetism exercises uninterruptedly and universally a powerful influence on all sensitive bodies, and have been fortunate enough to bring these new deductions respecting the inward powers of dead and living nature under rule and law, we may return to § 59, and take up the thread to extend it further in another direction. This will be effected by tracing the effects of the magnet and crystals on sensitive organisms.

It is well known that a piece of pure iron, free from carbon, however often it may be rubbed with a magnet, will not acquire an independent power of attracting iron, will not even lift up iron-filings. It therefore does not receive any enduring magnetic power from the magnet, and physicists agree that the iron returns unchanged into its former condition, as soon as the magnet is removed. But this is not absolutely the case. Hitherto, it is true, we have possessed no reagent that would indicate any alteration in the condition of iron which had been in contact with a magnet; but the sensitive human nerves furnish one. For when I allowed Miss Nowotny to take in her hand a rod of pure iron before it was touched with a magnet, I myself not interfering, it was perfectly indifferent to her; but when I brought it into contact with a magnet, and then keeping my hands away, removed this from the iron, and again allowed her to take it, she found it very different from what it had been before; for now it was no longer indifferent, but gave her the same sensation as a weak magnet, some heat and curling of the fingers, and this persisted decreasingly for some time, till after eight or ten minutes it lost its newly gained strength, and again became indifferent. Miss Reichel felt a magnetic rod twenty inches long when removed to several rooms off. This was connected by cross pieces with an iron armature of exactly the same shape and size. When I removed the latter from the magnet and tried its unaided effect on Miss Reichel's sensations, I was not a little astonished to see that when just removed from the magnet it was perceived almost at the same distance, reacting magnetically upon the sensitive patient even as the large magnetic rod itself. I made similar experiments with other sensitive persons at various times. The curling of the fingers did not occur in all, but the other reactions of the magnet were met with universally, the patients finding the force of the latter conveyed to the iron in a weaker degree, yet still of considerable strength when the magnet was powerful. *Therefore something must be left behind in the iron by the magnet; but this is not magnetism, and at present we are ignorant of its real nature.*

73. When, as may be read in all books on animal magnetism, a glass of water is placed between the poles of a horse-shoe magnet, consequently in the magnetic current, and is, as it is called, magnetized, every sensitive patient can not only at once distinguish it from common water, but the glass brought immediately after the magnetization to the hand of a cataleptic patient, attracts this like a magnet, and solicits it to follow, just as I have described in my treatise on the peculiar fundamental force of crystals, §§ 27 and 28. *Something must therefore have passed from the magnet into the water, and remained bound there, something which is not a magnet, which we cannot detect by any known chemical means, and cannot be recognised by any of the common senses.*

74. Our celebrated botanist, Prof. Endlicher, visited the patient Miss Nowotny, and witnessed a curious experiment performed by her physician. Prof. Endlicher advised the latter to pass the magnet over himself, and then to react upon the patient. To his surprise, he now, as had never happened before, could attract the hand of the patient with his hand, cause it to attach itself, and follow everywhere, just as the magnetized glass of water had done. He retained this power for almost a quarter of an hour: by that time it had by degrees disappeared. *The same unknown something*, which had been left in the iron rod by the magnet, and had likewise passed into the glass of water, *must, therefore, have been conveyed into the whole person of the physician;* it manifested itself here, from the same cause to the same effect, in his fingers.

75. This experiment was subsequently repeated in a variety of forms; in particular cases the physician let his hand lie in Miss Nowotny's, while he rubbed the back of it with a strong magnet.—The patient here said that she felt force increase in the hand of the physician, by starts, with each pass of the magnet. I have repeated the experiment with Miss Maix, and while I rubbed the back of my hand with the magnet as it lay in hers, I received the same

account from her. I here recal to notice that this patient is *not by any means* a somnambulist, nor never was.

76. In an earlier treatise (§ 29) I was obliged to mention, for the sake of historical consistency in my memoir, that *a number of objects of all kinds*, when rubbed with a magnet, subsequently exercised a reaction upon he patient, which was indeed weaker, but wholly of the same kind as that which the magnet itself produced upon them. I spoke there merely of one patient; since then, I have had opportunities of testing many nervous patients in different conditions, among them many who considered themselves healthy and followed their occupations; they are easily detected, for all feel the magnet directly a single pass is made over them with the horse-shoe. *All these persons*, however, who may be found in hundreds in a large city by merely seeking, *felt themselves affected exactly in the same way by all the objects which had been once rubbed over with the magnet, only in a weaker degree than by the magnet itself.* Any one who chooses may confirm this in any place, for there can scarcely be a country village so small as not to contain a nervously irritable person.

77. Since, then, it appears certain, and warranted by experiments and trials of very various kinds, that all persons who possess a certain degree of irritability of the nerves distinctly feel the magnet like a cool or gently warm wind, without touching or seeing it, but on mere approximation, and by passes made in their vicinity; further, that all these feel in like manner, only weaker, all material objects, of whatsoever kind, when they have been previously placed for some time in the line of the magnetic current,—that is to say, have been magnetized; from these two inductions a third immediately follows, which hitherto there has been an objection to drawing,—nay, which some have, in anticipation, resisted with all their might, and which seems to be especially an abomination to chemists,—namely, that *all magnetized objects suffer some unknown temporary alteration through the magnet, be this what it may. Therefore, magnetized water even, however strange it may sound at first, is altered water.*

78. If we now compare the effects of crystallic force, as I have explained them in my preceding treatise, with the above of the magnet upon other bodies, we see that the *influence of both upon a third body is exactly the same, and so identical that no character exists for any kind of distinction.* I have there shown that the magnetic force and the crystallic force—each taken in its totality—are essentially different, and deport themselves, in reference to their similarity, like a part to the whole; for example, like the heating ray to the sunbeam, like sulphuric acid to alum; but the modification which they leave behind in other bodies, when these are withdrawn from their

sphere of action, is exactly the same in both cases; and since these are perfectly exercised by the part, that is, by the crystallic force alone, we are compelled to conclude that this is *wholly effected in the magnet by the crystallic force residing in it: therefore by this part of its force. We find, consequently, the magnetic poles and the crystal poles agree wholly, and are perfectly alike in reference to their reaction on the animal nerves.*

79. And now our investigations have brought us to the portal of the so-called animal magnetism, this *noli-metangere* may now be seized. When I passed a magnet down twice from head to foot, over the patient, Miss Sturmann, she lost consciousness, and fell into convulsions, mostly with rigid spasms. When I did the same with my *large rock-crystal,* the same result followed. *But I could produce the same effect, when, instead of either of these, I used merely my empty hand. Therefore the crystallic force of the magnet and the crystal must reside in my hand.*

80. To test this further, I undertook a series of researches which I will now recount. If this were the case, the force of my hand must produce all the same effects which the crystallic force can bring to pass, as I have recounted them in my last treatise: from the similarity of the properties must be concluded the difference or identity. Before all, it must be inquired whether and what agreement exists between the effect of crystals upon healthy and sick human bodies, and that of the human hand on the same. The results of passing my magnetic rod or my large rock-crystal over a sensitive person, have already been many times detailed; I may here confine myself to a comparison of the two effects upon the hand. When, on those persons who were sensitive enough to feel distinctly the passage of a large crystal along the inside of the hand, I slowly carried my right hand, with the fingers' points turned sideways, down through their left hands, in such a manner that one finger followed another, and thus so swept over them that all passed over in one and the same line, which was drawn from the wrist to the point of the middle finger, I found none who did not feel this in the same way, usually as a cool, more rarely as a warm wind, and not only as strongly, but usually even evidently more so than they had felt the passage of a crystal. I shall not speak of the sick patients, for all whom I have named in my researches felt this as remarkably strongly as they usually did every magnetic pass of the hand. Miss Maix and Miss Nowotny felt each single finger. But even among the healthy there were not a few who displayed a very considerable sensibility to this reaction; nay, I even found some who, while they could not detect the passage of crystals with certainty, were so clearly aware of the

successive passage of the fingers, that they could always accurately state it, with the face turned away. I am empowered to refer by name to my friend, M. Carl Schuh, here. He is a healthy and strong man, and felt the pass of the crystals very distinctly. When I, unnecessarily, and against my own rule, bound his eyes, and carried the *row of fingers* of my right hand slowly down over his left, he felt this so strongly and so distinctly, like a crystal, that he could accurately mark each single pass, and each time spoke precisely when my fingers had passed over a third part of the distance. Mr. Studer, whom I have already mentioned, perceived this just as distinctly; and many other persons, among whom I have permission to name one of the most vigorous, well-inured, and finest men, who has traversed Persia and Kurdistan, and twice penetrated from Egypt into the heart of Asia, therefore is a rare example of an iron constitution, namely, Mr. Kotschy, sometime fellow-traveller with Mr. Russeger. The effect showed itself more strongly upon him; the more agreeable temperature of the air was increased as soon as it became cold. *The fingers, therefore, act upon the nerves exactly like a moderately strong crystal.*

81. I next wished to undertake the comparative examination of the sources of the two forces as to the capability of being conducted through other bodies. I made Miss Sturmann grasp one end of a German silver conductor in her right hand, without having previously touched it myself. I first allowed her a little time to accustom herself to the feel of the conductor; then I placed upon the other end the slightly moistened tips of the fingers of my right hand. Instantaneously she experienced a warm sensation in the part in contact with her hand, which passed upwards through this and ascended to her elbow. I placed the five fingers of my other hand upon it; the sensation was strikingly strengthened, and now propagated to the shoulder. I took my fingers away; the sensation rapidly decreased, not, however, disappearing suddenly; I put my fingers on and off alternately; the increase and decrease of the sensations produced kept pace. Another day I induced Dr. Lippich to do the same; his fingers produced the same effect. I made the same experiment with Miss Maix. I made her grasp the same conductor, without my interference, and, after some pause to accustom her to the metal, placed first my five, then ten, fingers upon it. The warm sensation appeared and disappeared as I put my fingers on and took them off; with all ten it was so strong that it ascended through the whole arm to the head. I bade her physician make the same experiment; he did so, with the same results; however, although he was ten years younger than myself, the effect of his fingers was evidently weaker than that

of mine. By accident, Father Lambert, of the Franciscans, her confessor, was present; I bade him try his power. She found his power equal to mine. I also desired the matron, Miss Barbara Pschierl, to try. Her fingers produced the same effect, but much weaker, than those of men. I repeated this experiment another time, with the modification of taking an iron wire, five feet long, instead of the German silver conductor. One end was grasped by the patient, accustomed to it for a few minutes; then the other end was touched with my five fingers, and the patient immediately said she felt a sensation of a flow of strong heat: when I placed ten fingers on it the sensation increased, while every time I let the wire out of my hand it disappeared again. This was tested by numerous repetitions. After that, I had the ten fingers of a young lady, her sister, who was also weak and nervous, placed, instead of mine, upon the end of the wire; the effect was remarkably weak. The ten fingers of another girl were added: the effect was observably stronger, but all the twenty together did not act nearly so strongly as five of my fingers, although I have long been grey and bald. I also tested these conditions with a copper wire. It was ten feet long, and also conducted the force, but more slowly and rather more weakly than the iron wire. The same experiments, varied in many ways, were repeated by me, with the same results, on Miss Reichel. The effect was very strongly exhibited in Miss Atzmannsdorfer. But even the healthy Mr. Studer possessed so much sensibility, that he clearly felt the effect of my hands upon metal wires. It follows from all these experiments, *that the force of the human hand may be conducted through other bodies, exactly like the crystallic force, and that these bodies are capable of conducting the two forces in the same way.*

82. I now wished to investigate the capability of accumulation. First, in Miss Sturmann, I placed the German silver conductor near her, and let it remain a quarter of an hour. Then I told her to grasp it, and to accustom her full hand to it. She laid it down near, and left it. I now held it for some seconds in my hand, and again laid it down. When she grasped it again, she felt it warm, and so strongly charged, that the well-known sensation which the crystals had produced under other circumstances, ascended along the whole hand up to the elbow-joint. This was of course repeated, for confirmation, under different modifications. Her physician, Dr. Lippich, made a similar experiment. At my request, two exactly similar porcelain saucers were placed on a distant table; one he left untouched, the other he held for a short time in his fingers, and then laid it down, where it remained a few minutes. They were now brought to the patient. She named the saucer which had been sub-

jected to the effect of the contact of the fingers, with the greatest ease and certainty. After about ten minutes the effect had disappeared, and the two saucers felt exactly the same. I repeated the experiment with the conductor, in the same way, on Miss Maix. It afforded perfectly similar results; it was charged by my fingers, and the charge which had been found to endure five minutes by Miss Sturmann, was detected, gradually decreasing, for twenty minutes, by the more sensitive Miss Maix. The effect was perfectly similar in both, a sensation of warmth ascending from the hand to the arm, and agreeing completely with that which the rock crystal had produced under similar circumstances. I found just the same in Miss Reichel and Miss Atzmannsdorfer some months later. But a glass of water ever remained the most remarkable. When this was taken in the hand, enclosed below in the fingers, the other hand placed above, and the inside also closed by the fingers, and thus held for some ten minutes, it acquired for sensitive nervous patients the smell, the taste, and all the remarkable properties of the so-called magnetized water, which those may make a foolish outcry against who have never investigated the matter, to which number I myself once belonged, but of which all who have examined it and seen its effect can only speak with astonishment. This water wholly agreed in its essential properties with that which had been treated with the magnet or with crystals; therefore received an abundant charge from the fingers and hands, of that peculiar force residing in them, and retained it for some little time. Finally, I could, without selection, take any possible object in my hand, keep it there for some time, and give it to the patients: they then affirmed, of all which they had previously had in their hands, that they had undergone the same change as when they had been rubbed with magnet or crystal poles; and this whether they knew of my interference, or it had been kept secret. From all these things it undoubtedly follows, that *the force of the hands possesses the same capability of accumulation as the crystallic force.*

83. That this charge *gradually disappears again*, appears from what has been stated already, and requires no especial proof. From these two things it further follows, that in the bodies which acquire a charge, and lose it gradually, *must reside the same power of coercion for the force of the hands which they have shown for the crystallic force.* The *magnitude of the charge* of other bodies increased with the strength of the hand, and the *capacity for charge* displayed no limits but the proportionate strength of the charging body.

84. The question whether there exists a dualism of this force in animal bodies, as in the crystals, required to be subjected to comparative tests. Crystals are known to possess, in crystallographical

respects, several axes, main and secondary, and in the compound systems, several main axes. When I tried the sensitiveness of the patients on them, they all, as I have already stated in the preceding treatise, after a short investigation found me the main axes and its poles,—those two points, namely, at which the action of the crystallic force on the tips of their fingers was most strongly and strikingly concentrated. But in many, especially in sulphuret of iron, selenite, fluor spar, heavy spar, sphene, granite, &c., they would also discover other axes, the poles of which were much less strongly opposed, but still gave evidence of a marked dualism. All the patients agreed in these perceptions; and a selenite, which I took from one to the other in succession, and allowed them to feel between the fingers of both hands as it lay upon a table, afforded me the same results in all: each described a strong main axis, with its stronger and weaker pole, and far weaker secondary axes, and all at exactly the same points and lines; very frequently the main axis was not the longest, but a shorter, particularly in selenite; and this agreement among all these mutually unknown observers was here the best possible warrant of the reality and correctness of their statements. Moreover, they may readily be tested elsewhere, for no populous town can be without suitable nervous patients. But even healthy sensitive persons, Mr. Studer in particular, could, without much trouble, discover the poles of crystals with his fingers. The axes and poles always coincided with the axes and poles of crystallography, and thus it became more than probable that the crystallic force takes part in (if it does not wholly effect) the construction of crystals. Perhaps it is to crystals what the vital force is to organic structures. Yet I will not venture into conjectures here, but hold to that which displays itself as fact: the crystallic force exists in a polar condition in crystals, and contemporaneously in several axes of a crystal, only in unequal degrees of strength.

85. I next met with similar conditions in animal life itself. It has been assumed that in man there is a main axis, from above downwards, and the brain and the genitals have been regarded as the opposite poles. If I ventured to draw a conclusion from observations of the so-called animal magnetism, I should say that it is not the main axis, but a secondary. In the first place, it has been shown above that patients on whom the magnet acts, bear that position worst of all which gives a longitudinal direction in the magnetic parallel; the body becomes thus magnetically differenced according to the latitude, which it appears unable to bear. We know of something similar in exposure to cold; when it comes laterally, it is at once much more injurious and powerful than when it comes in

front or behind. This has become more evident to me, through other circumstances, which I may here notice. When I gave the very sensitive Miss Maix my right hand, and placed it in her left, she felt it in the same manner as when I placed upright on her hand a little magnetic rod, or selenite, four inches long, both with the northward pole. But when I gave her my left hand, she found it very much more agreeable. If I laid my right hand in her left, and, at the same time, my left in her right, as is usual when one extends both hands at once to a friend, she said it seemed to her to run as in the "ring-game," (the name given in Vienna to tilting) up the right arm, through the heart and shoulders, down the left arm again, and through me till it reached her again, and thus incessantly around in a circle most painful to her, and making her giddy. When I now crossed my hands, so that my right was in her right, and my left in her left, she would not bear it, and said that it produced such a painful sensation of a strange kind of contest and strife in her arms and through the heart, a sort of wave up the arms and down again, that it was altogether insupportable. And after she had snatched her hands from mine, she so decidedly refused to give them a second time, that I was obliged to give up the critical repetition which I always made in all other experiments.*

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* The Baron has been very fortunate in some of his cases. The phenomenon here noticed is a very rare one, and many cases of sick sensitive, and many others well mesmerized, might be most closely examined without yielding the facts stated in this paragraph. Nature is ready to indulge her votaries with abundance of truths, but they are not poured out at once to even the most industrious, the most ingenious, and the most closely logical investigators. Man must wait his opportunity, and garner patiently. By these hints, can it be supposed that a doubt is entertained as to the facts detailed? By no means. But while, on the one hand, there is a desire to show that there must, in the present state of our knowledge, be a vagueness, inseparable from the very conditions of inquiries into organic laws, in arriving at a conclusion on such a matter as that of the polarities of the two sides of the body; on the other, there is abundant reason to believe that, although a hundred inquirers may not find, may not be able to corroborate the accuracy of the Baron's statements, there are facts enough to prove the existence of the class of phenomena which must in time prove all his positions. Herein lies the value of his logic; of his patient, unwearying powers of investigation. Storms may arise, clouds may darken the horizon, the common ken may not see the progress of the vessel he is steering--but she is guided by a genius, and must emerge from amid the dark doubts of ignorance into the light of truth. There are persons who may exhibit transiently the decided symptoms of Miss Maix's case—perhaps some for a few weeks, some for months, and there the peculiarities may vanish. The facts are not, however, the less valuable. They are to be stored for useful purposes. I have examined many impressionable subjects, in order to witness the phenomena determining the fact of the opposite polarities of the two sides of the body. I am convinced of its existence, as I know there are yes and no, positive and negative, plus and minus, attraction and

86. Since, then, it clearly results from all these experiments, that it is by no means indifferent which of the hands is offered to a nervous patient in the various contacts, it follows with certainty that the two hands are not in the same condition in reference to the hidden power that resides in them; and, if I do not altogether misunderstand the last experiment, there existed a kind of course, like that of the galvanic current, from my left hand to her right—and onward from her left to my right—a motion which could not force its way, or, meeting with considerable obstacles, tried to break through in spite of them, when I placed the left hand in her left, and the right hand in her right. This difference of the two hands can be nothing else but the well-known polarization, such as we are acquainted with in the magnet, and has been long known to us in crystals. In this point of view, the main axis passes transversely through man, and indeed through all animals; the longitudinal axis is to be regarded only as a secondary axis. In reality, we are transverse, and composed of two symmetrical halves. All cerebral organs, organs of sense, masticating apparatus, arms and hands, testicles, and feet, stand transversely opposed, and in this direction principally are we universally polar.

87. I subsequently investigated these interesting conditions in the same manner in Miss Atzmannsdorfer. The same results were presented in the same way as those just detailed; when I took her two opposite hands, she felt the current up the right arm and down the left still more strongly than Miss Maix. When I gave her my crossed hands, scarcely a minute elapsed before she was so affected that she became quite ill. When I gave into her hand one of the German silver conductors on a long brass wire, and touched this

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repulsion, &c. But though I have seen the phenomena slightly but clearly defined occasionally, and but rarely, among those I have had under my own treatment, I have never had the Baron's good fortune to witness the striking facts he describes. In one of Dr. Elliotson's cases, however, I saw an example even more remarkable than that of Miss Maix. It occurred in a young man subject to epilepsy, and I refer the reader to some details of it which may be found in the second volume of the *Zoist*, at pp. 53, 215, 216; and in the third volume at p. 53. The young man could not suffer his feet, ankles, knees, hands, or elbows, to touch each other. He could not endure the application of a finger of his right hand lightly to the left side of his face, or any part of that side of his body; nor could he allow any finger of his left hand to be ever so lightly applied to any part right of the mesial line of his body. If Dr. Elliotson touched with his left hand young A.'s right hand, he instantly showed signs of uneasiness; and the same if his right hand were placed in contact with any part of the left side of the young man's body. Many of Dr. Elliotson's observations and details of facts given in the volumes of the *Zoist* are curiously, because unintentionally, corroborative of the Baron's facts.

with my right hand, she had the peculiar secondary sensation, which I had also met with in Miss Sturmann, that this body seemed to her to become light, almost like down; on the other hand, when I touched it with the left, it became heavy, and seemingly much heavier than it naturally was. Without wishing to enter more minutely into this at this moment, I nevertheless must mention it, insomuch that it furnishes another character to the opposition of the hands, in a kind of attraction and repulsion. Yet, different as she found my hands in their effect upon her, she perceived no less difference in her own. When I placed in one of her hands things like iron pyrites, selenite, reguline metals, charcoal, &c., they produced sensations very unlike those which they caused when I bade her transfer them into the other, although no kind of weakening of one or other half of the body in any way existed in her.

88. I have very recently gone through an investigation of this particular with Miss Reichel, and traced it to further development than in any of the former sensitive persons. She found not only her right hand, but the whole right side, from head to foot, opposed in all its properties to the left; nay, the mere approximation towards her of my right or left hand, affected her in an essentially different manner. I shall detail this more fully in a subsequent treatise; here, where we are concerned merely with the proof by facts of a magnetic polar difference in the transverse direction in the human body, I must be content to state, that the observations on Miss Maix were repeated, found the same, and confirmed anew.

89. It appears from all these investigations, that all the symmetrically placed organs of the animal body, so far as they were here investigated, but especially *the hands, exhibited a difference which is caused by a magnetic polar opposition ; and that consequently a dualism of the fundamental force now under consideration exists between them, wholly in the way that we have found it to occur in crystals.*

90. I have shown above, § 41 and § 53, that the terrestrial magnetism has no observable influence upon crystals, and not the slightest directing power. The same holds good in relation to the force of the hands. The force which I exert actively with my hands is always equally effective in all places and positions that I assume.—Neither can I perceive any influence upon me passively: I have tried lying down to sleep in various directions, but to whatever quarter of the heavens I turned, I slept equally well: and the perfectly healthy man, who perhaps never is sensitive, undoubtedly never feels the least influence of the terrestrial magnetism, however actively and variously this re-acts upon the sick. Neither can I detect in animals

anything which indicates the least dependence upon terrestrial magnetism. If a free sense were devoted to this influence, we might expect to find it in larvæ, which are blind. As silk is cultivated on my estates, I had many opportunities of observing the deportment of these so low organisms in all stages and conditions. Yet, even in spinning and changing into the chrysalis, the animal never selected any definite direction, but placed its cocoon irregularly in all possible directions; not even a majority exhibited a preference for any particular direction during their dormant state. Therefore, the crystallic force and the force of the hands agree perfectly in this insensibility to the universal magnetic force of the earth.

91. In reference to the remarkable direct attraction of the patient's hands, exerted so strangely by the magnet and crystals, it has already been stated, § 74, that a man's hand actually effects this, but only when it has previously been rubbed for some time with a strong magnet: he could not do it by his own force. But it has also appeared that he was not very strong in magnetic force. At least, Miss Maix has found his appreciably weaker than those of Father Lambert and mine. I neglected, myself, to make a proper trial upon the cataleptic Miss Nowotny at the right time, because I was not then sufficiently aware of the value of it. On the other hand, I have seen this phenomenon in Miss Reichel and Miss Atzmannsdorfer many times, in the higher stages of their diseases, and in particular in the former, in the presence of many other persons. In the catalepsy which usually preceded her convulsive fits, her hand followed pretty readily the fingers of my vigorous young man, as also my own. I have often made her rise from the seat in a state of unconsciousness, and follow my fingers a considerable distance along the room. Even when I held before her, in this condition, things which possessed no polar distribution of their own, such as a piece of chalk cut to a point, I could lift up her hand with it, and if she, by chance, stood up in the cataleptic state, in her room, I could lead her some paces on. In this case it was the force of my fingers conducted through the chalk, and concentrated at its point, (according to the laws developed above, § 81,) where the chalk represented the sum of my fingers, and so perfectly took on their force and action, that it attracted and drew on the hand of the patient, when I walked backward with it, just as my fingers had themselves done. I observed this attraction by my fingers in the same way during Miss Atzmannsdorfer's attacks. Miss Sturmann's attraction I did not witness myself, but it occurred in exactly the same degree in her, and I can trust the statements of her physician, Professor Lippich, as fully as my own experience. From all these different discoveries, it is cer-

tain that a *mechanically attractive force, acting upon the hands of cataleptic patients, resides in the hands and fingers of healthy men, just as in the poles of crystals.*

92. But the luminous phenomena, which I have still to enter into, form a brilliant point in this comparative examination. As I saw Miss Reichel for the first time after violent spasms, with closed eyes, playing in a sort of half sleep with the magnet flame, which always gave her great pleasure, I interposed my outstretched hand, in the darkness, between the magnet and the patient. She immediately began to play in the same manner with the tips of my fingers, and to talk to the bystanders of five little flames, which leaped up and down in the air. She did not perceive my hand itself, and took the movement of my fingers, on the points of which she saw the flames, for an independent movement of the latter. All present, one after another, raised their hands, and each desired to know whether fire issued from his fingers. The patient saw it on all men's fingers, more or less strongly; but not one single girl's fingers emitted sufficient light, or at most but a feeble luminosity, and her own none. As long as Miss Reichel remained ill, these experiments were often repeated, frequently for the alleviation of her spasms, or even for the mere amusement of many spectators. But when she had got well, it appeared, as had not been reported at all before, that not only during sickness, but in health, she saw the magnet flames, the crystallic light, and the flames on the hand, whenever it was dark enough. In fact, she had possessed this power from her earliest age; even as a child her mother had often lifted her up, to let her convince herself that the imaginary fire which she often cried out about, did not really exist on the nails and hooks sticking in the walls. She even had two sisters who in like manner saw luminous appearances, in all places, of which other people could perceive nothing. Now, while I am writing, she serves me daily for investigations which I am making in this subject, on the connection with electricity and magnetism, and of which we shall see after a time, from my reports, to what conclusions this has led, and will further lead. I was thus placed in a position to examine the luminous phenomena on the hands in the coolest and most comprehensive manner during a long period, and I am still daily continuing this examination.

93. The investigation on Miss Atzmannsdorfer gave essentially the same results, only she saw all the flame-like appearances larger: while the former patient, according to the degree of her diseased excitement, saw the finger-flames from a little less to a little more than an inch long, the latter saw them, in the dark, two inches and more in length; thus almost the whole length of a finger. I shall give,

with one of the succeeding essays, drawings of these beautiful appearances, as I obtained them from Miss Reichel. Here the purpose is fulfilled by the facts, warranted by several observers, that *fiery brushes of light issue from the points of the fingers of healthy men, in the same manner as from the poles of crystals.*

94. I have now compared the properties of the crystallic force, without exception, as enumerated in my earliest treatise, with the force that the human hand is capable of exercising: the parallel between the two is, as is evident, complete, and the agreement of the two forces, in their general expression, so perfect, that they evidently become identified. For the sake of clearness I here give the principal results *seriatim*, in a compressed form:—

Hands, passed over the sensitive, act upon them like crystal poles, § 79.

The force that here rules is conductible through all bodies, like the force of the crystal, § 80.

It may be accumulated on other matters, like the others, § 81.

It disappears from the charged substance in a short time, like the other, § 82.

Matter has a coercive power over it, as over the other, § 83.

The capacity of bodies to receive a charge is, for this, like that for the other, § 83.

It has a polar arrangement in the human body, as the other has in crystals, § 89.

It is as little influenced by terrestrial magnetism as the other, § 90.

It exerts mechanical attraction on the hands of the sensitive, like the other, § 91.

It displays luminosity of the same nature and power as the other, § 93.

And thus we come back to the starting point of this section, § 79, namely, that the same force really resides in the human hands as manifests itself in crystals; that thus *the crystallic force and the so-called animal magnetism are thoroughly identical, aud therefore that the same laws which rule the former are also fully applicable to the latter.*

RETROSPECT.

a. Not only crystals exert a peculiar kind of exciting power upon healthy and diseased sensitive persons, but the like occurs with the terrestrial magnetism. This is so strong, that highly sensitive patients can only sustain it in a certain direction, namely, when placed with the head to the north and the feet to the south, and that every other direction is painful; in many cases, that from west to east wholly insupportable, and even dangerous.

b. All magnetic, crystallic, and similar re-actions on such nervously excitable persons, are essentially modified by alteration of their direction in regard to the terrestrial magnetism.

c. Pure iron, devoid of carbon, and which contains no intermixture of particles of steel, rubbed with a magnet and then removed from it, does not, as is well known, acquire any permanent magnetism; but it nevertheless acquires a peculiar force, by means of which it becomes capable of exerting a distinct and powerful action on very sensitive persons.

d. The magnet imparts this unknown something, not merely to iron, but to all other metals, stones, salts, water, plants, and animals, even to living men; in short, to all solid material objects, without exception.

e. This something acts in all objects either immediately charged with it, or rendered active by the so-called distribution, on the sensitive nervous persons, exactly in the same manner as the magnet itself and as crystals, and must therefore be identical with the peculiar agent of these.

f. Living men are able to affect sensitive, healthy, and diseased persons, exactly in the same way, especially with their hands and fingers.

g. This force, which physicians have called animal magnetism, possesses the following properties:—It is conductible through all other bodies; it is capable of being either directly accumulated on, or transferred by distribution to other bodies; it disappears from them in a short time; it is fixable on them for some time by their capacity for accumulation and by their coercive power; it is arranged in a polar manner in animal bodies through its dualism; it is without appreciable relation to the terrestrial magnetism; it is capable of mechanically attracting the hands of cataleptic patients, and is combined with luminous phenomena; all exactly as the crystallic force is, with which it thus coincides, and in all particulars obeys the same physical laws.

h. The part of the force residing in the magnet, the crystallic force, and the force which is the basis of the so-called animal magnetism: these three forces, therefore, coincide in their essential nature, under one common point of view.

FOURTH TREATISE.

FURTHER SOURCES OF THE FORCE WHICH RESIDES IN CRYSTALS, THE MAGNET, AND THE HUMAN HANDS.

95. WHAT I have already brought forward here has by no means exhausted the sources from which the enigmatical force now under examination flows; in fact, I have not yet mentioned the principal of them. Following up the subject, I met with new and important facts. Physicists have, as is well known, for many years debated the question whether or no the sun's rays are capable of magnetizing a steel needle. Since Morichini, who published the first observations, Mrs. Somerville, Baumgarten, Configliaghi, and others, have taken the principal share in the discussion of this subject. Recollection of the treatises on this point led me to reflect on the part the *sun* might possibly play in the subject of my present researches, and which acquired some probability from the undeniable and well-known influence exercised by the moon in certain nervous diseases.

97. I availed myself of the first cloudless sky to experiment in this direction on Miss Maix. I placed the end of a copper wire eleven yards long in her hand, and as usual allowed her a little time to become accustomed to it. I then put the other longer end out of the window into the sun-shine. The effects of the crystallic force became immediately perceptible, in a weak degree, but distinctly. I next connected with the wire a plate of copper, sixteen square inches in extent, in the shade, allowed the patient to get used to the end of the wire, and put the plate in front of the window in the sun's rays. Scarcely was this done when an unexpected cry of pleasure greeted me from the sick-bed. Immediately the rays fell upon the plate, a strong manifestation of the crystallic force made itself felt in the hand, by the known peculiar sensation of warmth, which then ascended through the arm to the head. But this well-known and not unexpected result was accompanied by a simultaneous sensation of cooling, and this so strong and predominant, and with an experience of strengthening refreshment through all the limbs, that the patient

declared herself greatly revived and cheered by it. Heat and cold were felt together.

98. In a modified experiment, with the view to attain the results less complicated with the effect of heat, I substituted a white cloth for the copper-plate. I first attended to the accustoming in the shade, and then carried the stiff wire with the linen cloth attached to it into the sunshine. The chamber was warm, the outer air was cool. Nevertheless, effects presented themselves to the sensations of the patient as quickly, though more weakly, as from the copper plate; a dull feeling of increasing crystallic force in the wire, then the striking cooling and reviving sensation: the latter, however, tolerably vivid.

99. I varied this experiment by placing a wet cloth, instead of a dry one, upon the copper wire, which was held in the hand of the patient till she was used to it, and then placed in the sun. The effect was accompanied by a disagreeable accessory sensation, like damp air would have produced upon her; but the principal sensation, which is peculiar to the sun—increasing heat in the wire, and the refreshing cold which presented itself and spread over her whole body—was manifested in the most vivid manner.

100. I now sought for confirmation and warranty of these observations. Some days later I undertook the same experiments with Miss Nowotny. She had now so far recovered that she had quite left her bed for some weeks; but I nevertheless wished to test the influence upon her. One end of a wire was placed in her hand, the other in the sunshine before a window. She immediately felt alterations in that part which she held in her hand: it became cooler to her. I brought it back into the shade,—the coolness disappeared; I again placed it in the sunshine,—the coolness returned. I now attached about a square foot of tinned iron plate to the wire, and placed it in the sun. The cooling not only quickly manifested itself, but increased for two or three minutes to such a degree that I received the assurance that the wire had become icy cold and begun to make the hand stiff. The plate was brought back into the shade, and the experiment repeated; but the sensation of cold immediately began to decrease, and in a few minutes disappeared; while, when the plate was brought back into the sun, it returned forthwith, and increased till it had attained the same intensity. I have already remarked upon the point that the peculiar sensation which the crystallic force produces in the hands of the sensitive sometimes expresses itself like heat, sometimes like cold; the particular differences of both will be specially elucidated hereafter. Here, where the cold depends on the sun, which otherwise is the source of warmth to all nature, it is pre-

eminently characteristic of a specific activity. This was expressed so powerfully and clearly that the distinction was found to be remarkable, according as I let the sun's rays fall obliquely on the metal plates, when the effect was weaker, or as they struck vertically upon them, in which case it was much more strongly perceived;—whether I made the experiment, in this way, morning or evening, or at noon; whether I performed them in July, or repeated them under the same conditions in November.

101. I had no opportunity to institute very circumstantial experiments on this point, on Miss Atzmannsdorfer; but I heard from her, in conversation, that in general the sun exercised a very agreeable yet not warming but pleasantly cooling influence over her whole body.

102. In like manner formerly, before I had become acquainted with this peculiarity of the sun's rays, I had often heard from Miss Sturmann the then enigmatical statement that the sun made her cold.

103. But I was enabled to investigate this subject most minutely by means of Miss Reichel. The sun's rays not only produced the peculiar sensation of cold when a wire was connected with iron, copper, or zinc plate, tin-foil, lead-foil, strips of silver, gold leaf, German silver, brass plate, &c., but also when linen, woollen cloth, cotton or silk stuff connected with it, were brought into the direct light of the sun. Nay, every other substance, porcelain, glass, stone, wood, water, lamp-oil, alcohol, sulphur; in short, everything I chose to select, when connected with the wire which the girl took into her hand, in the shade, and moved into the sun's rays, produced in her that striking sensation of increasing cold, to which the sensitive all unanimously and uniformly testified, as much surprised at the apparent contradiction which lay therein, as I was myself: which, however, the sequel will very clearly solve.

104. If it were actually the force of crystals, of the magnet, of the human hand, as I have identified them in the preceding treatises, which I now again met with in the sun's rays, this could only be proved by the same methods I had pursued in similar cases with the crystals, &c., by comparison of the effects. It was necessary, therefore, to raise and discuss the questions: Are the sun's rays capable of producing the same conditions in matter as the poles of crystals, the magnet, and the human hand are? Will mere sunshine impart to a piece of iron the force which is conveyed into it by the magnet? Has it the capacity to imbue all substances with the power of reacting upon sensitive sick persons? Can it produce a magnetized glass of water? Can the sun's rays, so often investigated, possess a new

and mighty force which has hitherto wholly escaped the glance of physical science? I scarcely ventured to admit such thoughts, but my desire for an explanation acquired strength daily.

The first thing curiosity led me to try was a glass of water. I let it stand five minutes in the sun, and then directed the waiting-woman, who possessed very little magnetic force, to give it to Miss Maix, without informing her for what purpose it was: without having been asked, she said that it was magnetized water directly she had put it to her lips. It produced the peculiar pepper-like burning, well known to the sensitive, on her tongue, palate, throat, down the œsophagus to the stomach, at every point arousing spasmodic symptoms. I allowed another glass of water to stand twenty minutes in the sun's rays before it was given to the patient; this time also by the weak hands of a girl, to avoid the stronger effect of mine. This was found as strongly magnetized as ever one could be by the large nine-layered magnet.

106. It was possible that a more considerable portion of the force might adhere to the glass than was contained in the water. To test this, and at the same time to obtain information of the internal condition of the water, whether or not it might be somewhat in the same relation as a tube full of steel-filings stands to the magnet, I had the solarized water poured into another glass, which was then given to the patient. The result was similar to what had often been experienced with magnetized water by Miss Sturmann and Miss Nowotny—that the transferred water was just as magnetic (as it is called) in the second glass as in the first, and that consequently the complete revolution of all its molecules had little or not at all modified the internal condition which constitutes what is called its magnetization. Even an hour after, when the remainder was drank, the so-called magnetism had not wholly disappeared, and though weaker than at first, it was still perceptibly charged. In this, as in all other characters, the solarized water agreed most perfectly with that which had been impregnated by the magnet, crystals, or the human hand.

For security, I subsequently followed out these experiments with Miss Sturmann and Miss Reichel. I shall take the liberty to omit an account of the accessory circumstances, which would only cause tiresome repetitions.

107. To follow out the parallel, I took the often-mentioned German silver conductor, and first placed it in the patient's hands to accustom her to it, then allowed the sun's rays to fall upon it for a few seconds, and immediately gave it back to Miss Maix. She found it rendered active just as when it had been placed in contact with a magnet, crystals, or the human hand; but at the same time she at

once perceived the pleasant sunny feeling with which the conductor also had been charged, and which it retained. According to repeated experiments, this persisted to her senses for five or six minutes, after which it became imperceptible; while, on the other hand, the crystallic force with which the sun had imbued it, was felt much longer, and in fact for the same period of twenty minutes that the same conductor had retained the force of my two hands, § 82. The rays of the sun, therefore, exactly equalled here the force of my ten fingers, and acted just as permanently by accumulation as the latter.

108. I allowed Miss Reichel to become used to the feeling of my hand, and then went out into the sunshine. After ten minutes had elapsed, during which I had exposed myself on all sides to the sun's rays, I went back and gave her the same hand. She was much astonished at the rapid alteration in the great increase of force which she experienced in it, the cause of which was unknown to her. The sunshine had evidently impregnated me in exactly the same way as the magnet had charged (§ 74) the body of a man, and in other experiments my own person. Miss Maix had already previously informed me that she could not bear any one coming out of strong sunshine to approach her bed. Some time before, a party of friends had entered her room after a walk in powerful sunshine; this had produced so much pain and uneasiness, that she could not sustain it, and had been obliged to beg her friends to leave her; and this had been merely the action of the sun, not the cooling, but that warming the hand-wire, § 97.

109. After I had given up the experiments with the sun's rays on Miss Maix, the girls of her neighborhood amused themselves with them. When I revisited her, they told me that the patient had found an iron key which they had laid in the sunshine, after a short interval, magnetic, and as strongly as a magnetic rod which they possessed. It did not attract iron, but Miss Maix declared that it acted upon her exactly like a magnet. The key had therefore acquired a magnet-like charge from the sun. It had not endured, but disappeared from the key after some time, as the crystallic force does from bodies.

110. This observation led the girls at once to further experiments, with astonishing results. They took a horse-shoe magnet which had become weak, and instead of rubbing it to strengthen it, laid it in the sunshine, and they had the pleasure to see their expectation fully confirmed. The horse-shoe became so much strengthened and newly magnetically active upon the patient, that thereafter, whenever a magnet became weak, it was only necessary to lay it in the sun to make it good again. This is a kind of confirmation of Zantedeschi's observations.

111. I now sought to complete these experiments, by a trial, with Miss Reichel, of the behavior of crystals in the sunshine. The fact appeared that a rock crystal and a selenite had scarcely been exposed to the rays of the sun five minutes before the girl felt the peculiar nervous excitement from it greatly strengthened. •

112. All these facts at once combine to afford the law: *The force of the sun*, corresponding to the crystallic force, &c., *is capable of being accumulated in other bodies.* And since they acquire this, charge and retain it for some time, *they possess a certain degree of coercive power over it.*

113. Its conductibility through other bodies has already been demonstrated by the conduction to the patient's hands by copper and iron wires; I will only subjoin a few more facts. When I placed the end of a linen cloth in Miss Reichel's hand, gave her the usual interval to get used to it, and exposed the other end to the sun's rays, while the hand remained in the shade, the sensation of the crystallic force soon advanced gradually from the linen to the hand, and produced cold in it. The same occurred when I gave her a woollen cloth, a piece of cotton or silk stuff, and let her handle it in the same way. When I drew the cloth back out of the sunshine, it lost its coolness in a few minutes, and recovered it again as often as I brought it back into the sun's rays. The conduction was most rapid through silk, next through linen, slower through wool, and slowest of all through cotton. A wooden rod, twenty inches long, conducted the solar force pretty rapidly; a measuring rod, six feet eight inches long, required more than half a minute for the effect to penetrate from one end to the other. But a glass tube conveyed the sensation to the other end, directly one end was placed in the rays of the sun. *Therefore, substances of every kind*, whether good, imperfect, or non-conductors of electricity, *manifest, without exception, the power of conducting that force of the sun's rays;* those which are continuous, easily and rapidly; others, which are composed of distinct parts, like woollen and cotton stuffs, with more difficulty, and more slowly.

114. I pass over the confirmatory experiments, and, in order not to dwell longer on these comparisons, hasten to the luminous phenomena. It was here an especial concern, and a very necessary trial, to examine whether the force of the sun was in the same way capable of endowing the objects with the power of emitting luminous flame in the dark. The laws of phosphorescence are known, and, according to these, it was impossible to bring one of the bodies upon which the sun had shined, at once into darkness: we know from Heinrich that in such a case a great proportion of solid bodies are luminous. The contrivance which I arranged for carrying on expe-

riments, in perfect darkness, while the sun was shining, was as follows. In my laboratory, a covered staircase leads down to a lower story, where my collections and instruments are kept: I had the windows of this closed up: when I closed both doors, I had perfect darkness upon the staircase. Communication was easy with this, and everything could be understood that was spoken both in it and in the adjacent rooms on the two floors. Miss Reichel expressed her willingness to allow herself to be shut up here; and I mention these accidental circumstances especially, because a great number of experiments on light were performed on this staircase: these will all be mentioned in their place, and bear reference to the locality just described. At the same time, this arrangement gave the best control to ensure the accuracy of the sensitive observer, who, shut up here far above or below the room where the operations were carried on, could never know what modifications the experiments underwent there; she could only be aware of their effects, and simply state how and where she perceived them. Up stairs, in the room, I had prepared several large sheets, half a square yard in extent, of copper, iron, and zinc, plates covered with gold leaf, large pieces of lead foil, linen dipped in melted sulphur, &c. I connected these, one after another, with an iron wire, about one-twelfth of an inch thick, thirteen yards long, carried this through the key-hole of the door, which was stopped closely all around it, and down the stairs, where the observer grasped it in her hand, keeping the end of the wire turned upwards. After she had remained quiet in the dark long enough for her eyes to become accustomed to it, I placed the objects above named, one after another, in the rays of the sun. Before quite a minute had elapsed, a slender column of flame, from ten to twelve inches high, and only two-thirds of an inch thick, ascended before her eyes from the end of the wire. It was gradually attenuated upwards, almost like a knitting-needle at the end, and spread an agreeable coolness all around. When the air was disturbed by speaking, it flickered backwards and forwards with it, as I have described of the flame of the magnetic needle. As the metal plates above were moved into the sunshine or into the shade, the flame in the darkness below rose and fell upon the wire, an interval of half a minute or more always elapsing before the manifestation of the change. I substituted a human being for the metal plates, and placed the end of the wire in her left hand. It was my daughter. By her own force, while still standing in the shade, she produced a little flame on the wire, which diffused warmth around, in accordance with facts already detailed. When she placed herself in the sunshine, the flame on the end of the wire shortly rose to a height of nearly nine inches, and now diffused a pleasant solar cooling. As often as she removed out of the sunshine, the flame sank to its previous inconsiderable size, and again emitted heat. I next brought some metal plates and other objects, by way of experiment, as rapidly as possible out of the sun's rays into the darkness, before the eyes of the observer. Without wishing to take account of the luminous flame which spread over them, since this, though not produced, might be more or less influenced by phosphorescence, it is still to the purpose to mention here that from the sharp angles of the plates, especially those turned upward, issued tufts of flame in the manner of the magnet and crystals; green and blue from copper, clear white from gold and silver, dull white from tin, dirty blue from lead, reddish white from zinc, white from a quicksilvered mirror, and blue with white points from a mass of crystals of sulphate of potass. Lastly, I brought a glass tube forty inches long and two inches wide out of the sunshine into the darkness; it was enveloped on the upper half, as held vertically, by fine white lambent flame, which passed at the upper end into a tube about three inches long, playing around the top.

I applied alternately polarized light, which fell at an angle of about 35° into the room through the window, and the direct rays of the sun, for which purpose was used a roomy balcony, to which there was ready access from the work-room; however, no distinction in the results could be perceived. All these experiments prove that *the force flowing on to matter, with the sun's rays, produces the same beautiful luminous phenomena as the crystallic and other forces do.*

112. Therefore, in every respect related here, *the action of the sun agrees with those of crystals, the magnet, and the human hand; and this, our fixed star, must be received as the fourth source of crystallic force.*

These observations, as is evident at the first glance, lead far in their more distant ramifications. I avoid, however, in the outset, entering into the infinite multiplicity of their relations in universal nature, because I wish in the first place to trace out and establish successively all the sources I have become acquainted with of the force now under consideration, and then afterwards to elucidate each singly, so far as I have been able hitherto to detect its peculiarity. Nevertheless, I cannot help casting a few glances at one of these many sides, because it is this very one which more directly establishes the mode of action of the sun. This is *the spectrum.* Since the sun's rays manifest the force in question, the question at once presents itself—whether this force resides in all the rays of the colored spectrum, only in one, or more or less in particular of them? I made a preliminary experiment in this direction on Miss Maix. I threw the spectrum upon a wall with a glass prism, placed a copper wire in the patient's hand, allowed her to become accustomed to it, and then, holding it near the other end in my hand, moved it slowly from color to color across the spectrum. She could not see me, for we were separated by a folding screen. Many and repeated experiments, both with her, and afterwards with several other sensitive persons, led to the uniform results; violet blue and blue were the principal seat of the solar agreeable influence, and of that reviving coolness which diffused itself throughout the body of the patient; consequently, that part of the spectrum in which exists the least intensity of light. On the other hand, the crystallic force, apparent warmth—nay, sensation of heating of the wire, although it was some six yards long, increased continually from the middle, from yellow to orange, so that it was most distinct and deep in the red. Here we find the maximum of the heating rays; the true warmth of which, however, was far from being able to reach the patient. These observations support the statements of Morichini and Mrs. Somerville, and place new weight in the scale of the probability of their assertions, which are as yet by no means universally received.

117. *Each end of the spectrum, therefore, had its specific strongly expressed influence upon the excitability of the sensitive persons;* the more minute and detailed examination of which will afford interesting further conclusions, and the elucidation of which will form the subject of one of the succeeding treatises.

118. From this point it was but a step to the moon, the trial of which necessarily pressed the more urgently upon me, from the well-known fact that countless terrestrial phenomena among the healthy and diseased show themselves to depend more or less upon our satellite, the causes of which we as yet know not. I made the first experiment on Miss Maix. It was not carried out without some difficulty. Her window looked toward the north, and the moon could not be got at on any side. In this difficulty I resolved to carry an iron wire one-twelfth of an inch thick through two rooms, then over an area, and from these, again, through three rooms, in all about 100 feet; thus alone could I obtain some of the moon's rays. I placed one end of the wire in the patient's hand, the other was connected with a large copper plate, which, with the usual precautions, was moved into the moonlight. After a short pause the sensation in the hand began to alter very much. Iron wire and copper plate had alone produced a warm sensation, as they always did. The effect of the moon, which became associated with this, was described by the patient as of a very violent and mixed kind, so that her accounts of it did not evince her usual clearness. Without delaying with the

particulars of the present merely preliminary experiment, the fact will suffice here, that active influence of the moon, conducted to the patient through a long wire, did really present itself. The sensation on her right hand was much more pleasant than on the left. But a point which did not occur in the sunshine, and manifested itself as peculiar to the moon, was a distinct kind of attraction toward the wire through the whole arm, so that she felt induced to follow along the wire with her hand. She ran her finger slowly along the wire, when she felt the attraction, and would have been inclined, if not in bed, to trace it out along its whole length. We meet here with something similar to that strange attraction which we have observed in the magnet for cataleptic persons, and from which little doubt remains that it is the irresistible attraction which so powerfully seizes somnambulists, and which, therefore, being conductible, may be conveyed by metals. The patient regarded it as really magnetic, only she said that this attraction was much stronger than that of the magnet. Yet I must repeat what I have already mentioned, that Miss Maix's hand never was perceptibly solicited by the magnet to motion or adhesion. The special local difficulties which prevailed here of continuing nocturnal observations of this kind, rendered it impossible to investigate these interesting phenomena more minutely; I therefore was compelled to turn to other sensitive persons to collect confirmations.

119. This I did in the first place with Miss Reichel, who afforded me abundance of help in variously modified experiments. Whatever object I placed in her hand, and after she had become accustomed to it, desired her to hold in the moonlight, she always immediately assured me of the access of exactly the same sensation as was caused in her when I placed the points of the crystals, poles of magnets, or my fingers upon it, or when the sun had shone upon it. *All substances made use of exhibited this susceptibility and conducting power.* Her sensation, however, was not cooling, but of gentle warmth; and the sequel will show that this girl, of all those with whom I experimented, distinguished most definitely and most uniformly, with objective reasons, between cool and warm, between which the sensations of the sensitive constantly fluctuated. When I put the German silver conductor into her hand, laid it down, and then moved it into the moonlight, immediately covered it with a shade, and after some pause, let her grasp it again, *she found it filled with the force with which the moon endowed it*, i. e. *warm*; passive and active *capacity for accumulation* were thus proved. When I allowed copper plates, lead and tin foil, zinc plate, silver and gilded surfaces, to remain some time in the moon's rays, and then conveyed them to her on the darkened

staircase, she found their pointed angles flaming with tufts of white, red, green, and blue light. When I arranged a metallic plate, half a square yard in extent, so that I could at pleasure bring it into the moonshine and the shade, connected a long wire with it, and carried this through the keyhole down the darkened stairs into the hands of Miss Reichel, who remained there, *she saw in every instance, as often as I let the moon's rays fall upon it, a slender flame arise, scarcely as thick as one's finger, perfectly straight, to a height of ten inches*, and disappear after a short space as often as I removed the plate from the moonlight. She always felt this flame warm: I repeated the experiments through three different full moons, and always with the same results.

120. From the foregoing, it follows that the moonlight is not mere moonshine; that, even though it brings no warmth to us, it brings together with its light *another powerful, hidden force, which exhibits exactly the same characters as that which resides in crystals, &c. Therefore the moon is the fifth source of this force.*

121. Since the heating rays of the spectrum had so strikingly strengthened the peculiar effect of the force now under investigation, I made it my care to follow out this phenomenon. Formerly I had observed that force in a kind of equilibrium, so in crystals, on the magnet and in the human body. Now, however, in the sun and moon, I no longer found it at rest, but in motion; it appeared to flow from the heavenly bodies, in the same way as—putting the undulatory things out of sight—we may imagine rays of light and heat to flow. I could not but be led by this to an examination of analogous facts in nature,—in the first place *to heat.* To this end I laid a large copper plate upon a broad piece of earthenware, arranged the usual connection by a long copper wire with Miss Maix's hand, put a cold brass tailor's goose upon it, with the heater in, and placed my right hand upon it. I allowed her to become accustomed to it in this condition. Then the iron heater was taken out, a similar one, heated so as to glow weakly, substituted for it, and the case again closed. I now held it a little distance above the copper plate, without letting it touch. At first, therefore, it only acted by radiant heat upon the metal plate. An increase of the known warm sensation, which is caused by the crystals, &c., at once came to the observer's hand from the wire. When I then placed the heated iron firmly upon the copper plate, and slid it slowly over the surface to diffuse the heat over a greater space, the sensation increased rapidly and strongly in proportion as the heat spread. The patient complained at the same time of a striking sense of weight in the hand. With the removal of the

hot instrument, therefore with the cooling, the sensation decreased and increased again alternately as I renewed the heating or cooling.

122. In another experiment of the same kind I placed one end of a strong iron wire in the patient's hand, and grasped it not far from the other end with mine, letting her get accustomed to this. Then I brought the flame of a candle to the extremity, and heated it gradually till the blue shades were produced. The heating by conduction did not reach my hand, and there was a length of forty inches between this and the patient's at the other end; therefore communication of common heat was out of the question. The sense of the force appeared immediately, grew with the increase of the heat, and soon attained such a degree that it penetrated through the patient's arm up to her head. It slowly disappeared on the removal of the flame, and was reproduced every time the flame was again applied in the same manner to the wire. I repeated the experiment with copper wire, in this way: I rolled it up closely ten times, and placed two burning wax candles under the coil of wire. The results were quantitatively greater, but qualitatively exactly similar to the preceding; and this in every repetition. I had a wooden vessel filled with cold water, the wire sunk in it, and then accustomed the observer to this. The cold water was poured out, and boiling water poured in. She immediately felt the impression of warm crystallic force flowing into her hand.

123. I now gave the experiments the reverse direction. I placed a piece of ice in the hot water, from which the wire led to the patient's hand. The form of the phenomena was immediately changed. The sensation of heat and the other symptoms rapidly decreased, a long drawing occurred through the arm and hand, the disagreeable warm sensation gave place to the entrance of that cooling which the sun's rays produced, and which diffused itself gradually over the breast, back, and whole person. Ice placed in the patient's hand at once produced cramps, and allowed no minute observations.

124. I went through controlling experiments with Miss Reichel. I heated with the flame of a candle one end of an iron wire above six feet long, to the other end of which her hand had been accustomed. Common heat could not reach her at this distance, least of all from such a weak flame, and in the space of but a few minutes. Nevertheless, the wire immediately appeared to become *warm, and then so hot*, that she wondered that I, who was so near the flame, could hold it in my hand; but with my healthy senses I did not feel the slightest rise of temperature; she at the same time felt *cool wind* flow *from the end* of the wire—the well-known characteristic of excited crystallic force, &c. I repeated the same with an iron wire of equal thickness,

but more than sixteen yards long; I obtained the same effects, but observably more slowly.

125. The question of luminous appearances was now examined. I placed Miss Reichel on the dark little stair case, conveyed a thick copper wire to her, and heated the further end of it with an argand lamp. A reddish-green flame four inches high rose from the end of the wire with the greatest heating, and fell and rose as I moved the lamp from and back to the wire. I performed a similar experiment with thick iron wire five feet long, one end of which was heated to redness in the lamp. At the other end a flame six inches long arose in the dark, and slowly sank with the cooling. A longer iron wire, over sixteen yards, with one end heated to redness and the other carried into the darkened staircase, gave a flame of a finger's length. *Luminous phenomena produced by heat are here placed beyond doubt.*

126. With these evidences I was for the time content. They proved, by the feeling and sight of different observers, *effects of both radiant and conducted heat, which agree in all respects with those that demonstrate the existence of the peculiar force of crystals, &c. Heat, therefore, is the sixth source of the same.*

127. *Friction* is of complex character in its effect; heat, electricity, galvanism, &c., take part in producing it. At the same time I thought it right to investigate its participation in the circumstances now under consideration. At the residence of Miss Maix I placed a copper-plate upon the deal floor, connected it with her hand by a copper long wire, and rubbed it gently with a piece of wood. A sensation of increasing warmth was immediately developed in the wire, and rose to apparent heat when I rubbed on the wood with greater pressure and rapidity. This sensation increased and diminished as I rubbed more or less. When I substituted my woollen coat for the wood, the same effect was obtained, but strengthened. With a silk handkerchief it was stronger still.

128. I connected Miss Reichel, by means of a brass wire, with a copper-plate which lay upon a wax-polished oaken floor. I placed a piece of wood on the copper, and rubbed it. She at once felt the effect of the excited force through the wire which she held in her hand. Tin-plate acted in the same way under like circumstances, but more weakly than copper. The end of the wire emitted flame visible in the dark in both. I sawed a piece of wood in the dark with a thin-bladed hand-saw. The observer beheld nothing unusual in the saw-dust which flew about, but the blade of the saw, to the extent in which it was in action, soon emitted a reddish light, as if glowing with heat, and a little flame sprouted from every tooth of it. Copper and zinc plates rubbed together with the hands only exhibited sparks

here and there. Zinc upon zinc and copper upon copper in like manner emitted little visible light. Gypsum rubbed upon gypsum emitted no light at all. Pieces of charcoal rubbed together appeared as if glowing red, from their points of contact down into their substance to the extent of a finger's breadth. Pieces of sugar rubbed together afforded the usual commonly visible luminosity, but the sensitive saw in addition to this a flaming light one inch and a half in extent surrounding the former. I saw two glass flasks rubbed against each other become fiery at the points of contact; but she saw these parts surrounded by flames as large as one's fist. Unglazed, therefore rough porcelain capsules, gave bright emissions of light visible to me, but only immediately on the flat parts strongly rubbing upon each other; the patient saw flames the size of an expanded hand on them. At this period she was so well that she daily, without hesitation, went about her employment through the crowded streets of Vienna.

129. I rubbed two glass tubes, forty inches long, across one another. I saw a long luminous streak on the line of friction in the dark. Miss Reichel saw besides this, around those parts of the tubes where they had been rubbed, delicate flame-like lights of a finger's breadth, which were so expanded laterally that they had the appearance of a fiery band. As long as the rubbing was continued, she felt the end of the glass tubes, more than twenty inches distant from the rubbed parts, become apparently very hot, which effect vanished immediately I ceased rubbing. She saw little flames as large as a finger issue from the borders, from which flowed out to some distance a gently warm wind. A similar result was obtained by rubbing two iron rods together: light on the line of friction, which however I did not, though she did see; sensation of apparent warming during the rubbing, and immediate rapid cooling when I ceased to rub; flaming emissions from the ends of the rods, and warm wind flowing therefrom.

130. In none of these experiments were the rubbed objects isolated, but lay sometimes on the floor, sometimes in my hands or in those of an assistant; there was therefore free passage for the escape of any electricity that might have been excited. It was impossible, again, that the heat produced by the friction of the objects could disappear so rapidly, as the appearances of flame vanished every time the rubbing was arrested; the contact electricity excited, produced in almost all the cases enumerated by the rubbing together of bodies of wholly identical substance, must have been so slight that it may be passed over; and in the very case when zinc and copper were rubbed together, and it therefore must have been excited, scarcely a trace of luminosity was manifested, so that galvanism can have had

just as little influential share in this action as frictional electricity: from similar reasons I hold that the influence of thermo-electricity could not have been strong enough here, to allow of the observed phenomena of such magnitude being attributed to it, but I am of opinion that in addition to the partial influence which these agents may have had, to the friction itself is to be assigned the greater part of the peculiar luminous appearances which the sensitive persons here perceived. And so I believe, though perhaps with less certainty, *that friction must be regarded as the seventh source of the force dwelling in crystals, &c.*

131. In the researches on the sun's rays and moonlight, we have already seen that *light* assumes an important position when we enter upon the question of the origin of the peculiar force with which we are now dealing. Whether this inheres by and for itself in light, or is only associated with it, or whether it depends on other radiations occurring simultaneously with light, are questions certainly of essential moment, but which, however, I do not regard as in place here, where the business is in the first place to determine the sources generally, the analysis of the inner nature of these sources necessarily remaining as the object of future inquiry. I will therefore merely investigate whether light in general is to be counted among them. The examination of artificial light still remained to be done. When in broad daylight I brought a lighted wax candle near Miss Maix, she felt that it produced a peculiar coldness in her. Several such candles increased this cold, which then attacked her whole body. I removed the candles from her, going a step at a time, to a distance of the length of two rooms, amounting altogether to nearly eight yards. The cold produced by them was diminished very much at this distance, but did not entirely disappear. She remarked that this cold perceptibly resembled that which was diffused from the wire carried to her from the sunshine. This, to her unexpected observation, reminded her that she had never been able to remain at certain ceremonies customary at times among catholics, consisting of strong illuminations at night with hundreds of burning candles; for instance, illuminations of the representation of the holy sepulchre, &c.; the burning lights had always so thoroughly chilled her, that she had been compelled to leave. But Miss Maix had suffered in a slighter degree from her at present greatly heightened complaint, during her whole life, and is to be regarded as one born sensitive, who at every age has been subject to the sensations dependent on it, even when she appeared healthy and went about. The peculiar influence of light upon her, from distances at which even radiant heat could be but extremely weak, and producing a sensation on the nerves diametrically opposed to that of heat, had therefore been always clearly

manifested, even at a time when no one imagined that there was anything abnormal in it.

132. Counter-experiments on Miss Reichel led to the same results. She felt a burning candle to give out cold at a considerable distance; two candles acted at almost twice as far; an argand lamp still farther off; at the greatest distance when a ground glass globe was placed over the flame.

133. I tested by the often-adopted methods, whether the causes of these direct sensations were transferable to third bodies, conductible through them, &c. In front of a copper plate, which was connected with Miss Maix by a wire conductor, I placed two burning wax candles in such a manner that she could not see them, and consequently could not receive rays from them. She experienced simultaneously, increased warmth in the wire, and the pleasant cooling sensation which the sun's rays gave her, only much weaker here than from the sun. This was repeated at different times with the same results. The same was performed with Miss Reichel. I placed eight burning stearine candles near a large copper plate; the observer was in the next room, her hand connected with the copper plate by a copper wire conductor. She perceived the effect very strongly, in the known way, and felt the coolness flowing from the end of the wire at a considerable distance. In a second experiment, in order to moderate the action of the heat I interposed a glass plate between the candles and the copper plate; the effect was very little diminished.

134. These results, according to which rays of fire-light on the one hand directly affect the sensitive, and, on the other, imbue other bodies with the peculiar force acting on them, producing thereby apparent alterations of temperature, moreover showed themselves to be conductible, and afforded flame-like appearances in the dark, led me to the conviction that not only the sun with the moon, but *light generally, is a source of the force detected in crystals, &c., and is the eighth of these sources.*

RETROSPECT.

a. The sun's rays carry with them a power to affect sensitive patients, which agrees perfectly with the force residing in crystals, the magnet, and the human hands.

b. The greatest influence in reference to a force corresponding to that of crystals is manifested in the outer borders of the red and violet-blue rays of the solar spectrum.

c. The light of the moon possesses the force now under consideration in a strong degree.

d. Heat is a source of it.

e. It occurs with friction, and

f. It appears as a result of the light of flame.

FIFTH TREATISE.

CHEMICAL FORCE—ELECTRICITY.

135. If we take a glance at the condition of chemistry in the times of Agricola, Kunkel, and Brand, we acquire some conception of the relations in which this science at present stands to the subjects of the present researches. Scattered isolated fragments of observations lie around, but in what a condition! To give an idea of this, I will select merely one example. For more than seventy years an instrument has been used in medicine, which bears the name of a magnetic tub (*baquet*); I scarcely dare describe it, for it will be an abomination to every one accustomed to a scientific treatment of natural knowledge. A small wooden tub is filled with a medley of the most absurd and senseless kind, stirred up with magnetized water, an iron rod inserted in it, and from this woollen threads are carried out to sick persons of various sorts, to whom is to flow healing vital magnetism. And this mixture consists of iron slag, broken glass, hammerings of iron from a forge, steel filings, roots, iron ore, grains of corn, sulphur, sawdust, glass plates, wool, pieces of old iron, aromatic vegetables, quicksilver, all magnetized and mystically stratified one above another. What that is pure and healing can come out of such a devil's kitchen? is the reasonable question. How any real magnetizing effect can be produced from a mess of this kind, will certainly be as incomprehensible to every physicist as it is to me. And yet all who have occupied themselves with magnetic cures agree that it is a constantly persisting fountain of magnetism which may be made to flow to the patients through the conductors, &c.

136. Every one who is acquainted merely with the rudiments of such matters, sees that this cannot be a galvanic, electrical, still less a magnetic apparatus; and yet it has an effect which, recognised now for seventy years, has some analogy to these reagents, and must be based upon a hidden something, whatever this may be; otherwise it could not have spun out its obscure existence to the present day. Asking myself what really might operate in it, only one thing seemed to have any clear relation, namely *chemical action;* room was blindly given for a planless play of affinities, and decompo-

sitions and combinations must go on slowly in the tub. In my previous researches I had discovered eight very different sources of one and the same force; the said force here flowed, according to the statements of the physicians, from a mixture of substances attacking and decomposing one another in most opposite ways: might not the chemical disturbance alone excite the same imponderable agent? Might not chemical force also be a source of that associated with crystals, the magnet, living organisms, the sun, heat, &c.?*

137. To investigate this, I took a glass of water, dissolved bicarbonate of soda in it, inserted the end of a wire five feet long, gave Miss Maix the other end into her hand, and placed a pinch of powdered tartaric acid upon the edge of the glass; then gave the patient the usual interval to accustom herself to the arrangement, and scattered the acid in the solution. As soon as the decomposition commenced, the same sensation of heat, then of cooling, came to the observer's hand, as when I had touched the end of the wire with my ten fingers, with a large crystal, or with a magnetic rod. This result displayed itself so quickly and powerfully, that it made the girl grow quite red. It uniformly persisted as long as the chemical disturbance continued in the glass, and subsided when this ceased.

138. I had thus seized the clew to crystallic force, &c., in chemical action; my next business was to acquire assurance of its certainty. I might, in the first place, be met by the objection that the electricity developed in the process of decomposition had acted on the sensitive patient. Lavoisier and Laplace, and more recently L. Gmelin, believed that they observed evolution of free negative electricity in the decomposition of carbonate of lime by sulphuric acid; Pfaff and others contest this. Without delaying with the discussion of authorities, I thought it safest for the concrete case, to apply myself to direct experiment. I connected a conducting wire with a Bohnenberger's electroscope, and carried it into the isolated fluid contained in a long-stemmed glass, in which I prepared a mixture of tartaric acid with carbonate of soda. The gold-leaf did not move. I applied the condensing plates, and added new portions of the salt and acid to the water in the glass; but not even now, after the separation of the plates, could any trace of movement of the gold leaf be detected. If free electricity did present itself in such a tumultuary action as this, it is not very probable in itself that it would appear in insensible

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* I must protest against the imputation of a medical veneration for the devil's kitchen on the part of the investigators into mesmeric phenomena in England. I never saw a baquet, nor ever thought of making one, but I rejoice that the ideas connected with such an absurdity have occasioned the Baron to produce this treatise.

amount, certainly least of all such as arose from the purely chemical share in it. I am, therefore, obliged to conclude that electricity here, where no current of it can be set up, is not set free; while that which might take part in the process, is, by known laws, again confined by the products in the moment of origin, through the chemical act itself. The effect upon the hand of the patient, therefore, cannot be produced by a current of electricity, and consequently it belongs entirely to those results which constitute the object of the present researches.

139. I return to the detail of the collected observations. I placed in Miss Maix's hands a glass of diluted sulphuric acid and an iron wire. After a pause, the wire was introduced into the acid, and the solution proceeded with an evolution of hydrogen gas. She immediately found the wire grow warmer until apparently very hot; while cool air was diffused all round the glass.

140. I placed in her hands a glass of water, upon which lay a paper containing some common salt, and after a short pause the salt was thrown into the water, which she gently agitated. She felt the glass acquire crystallic force for some time during the solution, then remain at rest; the sensation flowed upward to the arm.

141. Controlling experiments were made on Miss Reichel. First, the trial with the bicarbonate of soda and tartaric acid, then the dilute sulphuric acid with an iron rod inserted in it; lastly, also with the water and common salt: they all succeeded in the same way. I made further experiments with the following mixtures:—sulphuric acid with caustic soda; acetic, tartaric, fumaric, citric and hippuric acid, successively, in excess upon iron filings; sulphuric acid in excess upon carbonate of soda, &c. We had, at that time, freshly pressed wine-must in full fermentation, and I tried this; all these chemical actions gave abundant evolution of crystallic force.

142. I then took some weak solutions: sugar, alcohol, crystallized borax, crystallized carbonate of soda and potass, in water; then borax and sub-carbonate of potash which had been exposed to the air; sulphuret of calcium and of potassium; lastly, freshly-burnt lime. All these, when passed into water, produced either coolness or warmth in the wire, continuing until the solutions were complete, when the peculiar effects immediately vanished. *In every case, therefore, even when only fixation of water of crystallization or mere solution in water occurred, the chemical action developed a free manifestation of crystallic force, &c.*

143. I was curious to see whether a glass of water could be magnetized, as it is called, by means of chemical action. Here mere conduction through a wire could scarcely convey sufficient force; I

required the chemical action in the undivided expression of its power. To obtain this, I placed one glass within another. Into the inner I poured spring water, into the outer a solution of bicarbonate of soda. I threw some tartaric acid into the latter, and had it slowly stirred by a female hand, until the effervescence subsided. The inner glass was then taken out, and handed to Miss Maix, to drink. The water was found as strongly magnetized as if it had been exposed five minutes to the sun's rays, but not so strongly as in the earlier experiments with twenty minutes of sunshine. After she had tasted it, I subjected the same glass of water to the same process a second time; when she drank of it again, she found it almost twice as strongly magnetic. I afterwards repeated a similar trial with Miss Reichel, in which I used carbonate of potass and sulphuric acid with the same results. *Consequently, we can render water magnetic by chemical force as well as by the magnet itself.*

144. During the above experiments, I made both Miss Maix and Miss Reichel hold separate copper conducting wires, the ends of which were dipped in dilute sulphuric acid. One of these was nearly 100 yards long. But the effect was manifested even at this great distance, and Miss Reichel perceived at the end of the wire which she held in her hand every insertion and removal of the opposite end, which were evident to the hand, not instantaneously, but after a little interval of from fifteen to twenty seconds.

145. There still remain the investigations on the luminous phenomena, abundance of which I went through carefully with Miss Reichel. On the one hand, I tried a series of chemical and mechanical solutions alone; on the other hand, according to their effect upon the opposite end of the conducting wire dipped in them, in the dark. Sugar, carbonate of soda, borax, &c. were dissolved separately in glasses of water. A glass rod was used to stir them. Even before this was applied, the contents of the glass emitted a red light in the dark. A fine luminosity began to sweep over the fluid, flowing upwards. A largish tuft of light ascended from the further end of the glass rod. As I dropped the pieces of sugar into the water, and they became wetted, they emitted a red light, according to the observer, and sank in the water like red fragments. Therefore, the evolution of light produced by the process of solution commenced instantly the sugar came in contact with the water. As I stirred it slowly in the dark, I myself saw very strongly luminous flashes from the sugar, at each gentle friction with the glass rod, and here, in water where the whole outer surface of the sugar was half dissolved, it could scarcely, or only by a great stretch, be assumed to be electrical, as the flashes produced by rubbing loaf sugar, chalk, &c. in the air, are commonly

imagined to be, although there is not the slightest evidence for it. I placed some freshly-burnt lime in a porcelain capsule, and dropped some water on to it. As soon as the internal disturbance connected with solution began, and steam appeared, the entire mass of lime appeared to the observer to glow with a white light, and a dull blue flame rose above it to the height of a hand. She imagined the dull appearance to be caused by the aqueous vapor. These flames endured of the same size for about a quarter of an hour after the chemical action had ceased; they then began to sink, and ceased in half an hour. Sulphuric acid poured into water at once formed red flames in the glass, waving on the water. When I stirred, these increased so much, that they rose to the height of a full span above the glass. The effect of heat was here evidently associated with that of chemical action. The glass-stirring rod also acquired a tuft of flame on its upper end. Fermenting wine-must emitted a continuous yellowish dull flame.

146. An iron wire 30 yards long was led in the day-time to the observer, placed on the darkened staircase, and the outer end dipped into dilute sulphuric acid. After the lapse of half a minute, she saw a slender column of fire, a span and a half long, ascend from the extremity, and this rose and sank as the wire was moved in and out of the acid. The same recurred with a solution of sugar in water; the flame at the end of the long wire was even somewhat larger than from the action of sulphuric acid upon iron wire. In another experiment, a brass wire four yards long was employed; it gave the same result, with the slight difference that, where the iron wire flame had appeared white and reddish-blue, the brass wire emitted a white and green light. Dried lime stirred up in excess of water gave a flame a span high on iron wire. Thus in every case, *when chemical action occurred, light and flame also appeared to the sensitive in the dark.*

147. In an examination of the chemical causes of the potential essence here investigated, I would not omit the flame of burning bodies, which is in the highest degree a chemical process. But since it is associated with heat and the development of light, there did not at first appear any prospect of obtaining similar results. I might have included the experiments made in this respect just as well under the treatment of heat or light. I brought a pan full of glowing charcoal near Miss Reichel. At a distance of a yard she found it cold; she felt it cool at the whole length of the room. I have already detailed the effects of the flame of candles on the sensitive. I lighted a shallow capsule of spirits of wine, then of pure alcohol, and allowed them to burn away; she felt cold from both flames at a slight dis-

tance. I burned various substances, both positive and negative, in her presence, such as resin, sulphur, and globules of potassium; all of these, especially the last two, were found cold. But it cannot be simply determined here what emanation it was that produced coolness to the sensitive, and was the ultimate cause of this crystallic force. Light appears to take proportionally little part in it, for the effects of alcohol and of sulphur, from which there is little evolution of light, were not found weaker than that of stearine candles. Real heat almost always afforded sensations of apparent heat, as we see by the last treatise. Since, therefore, the flame here always emitted predominant cold, the reason of this must be either in the products, or, as is most probable, in the chemical action itself, as this does so in all decompositions without flame.

148. From the present investigation of chemical force, we will pass immediately to one on the voltaic pile. Since the hydro-electric chain is one of the most important foci of chemical force, I shall take the liberty to anticipate the final result of this, namely, that there, also, a great spring of crystalline force flows from the interchange of matter, with all the attributes which we have observed in it elsewhere. This invasion of the system of the present work must be excused, on the ground that it is necessary to collect all kinds of chemical processes in the subjoined deduction.

149. The parallelism of the properties of the so-called magnetic phenomena associated with chemical force, with those which we have found in crystals, the magnet, human hands, heat, light, &c., is complete, and *chemism declares itself as the ninth in the series of sources of this force.*

150. The field of these researches here opens out to an immeasurable extent; but this can scarcely surprise; such a result must have shown itself in the distance with the earliest discoveries in crystals. Chemical action, solution, decomposition, combination, interchange in the groupings of the elements, stand in such close connection with the destruction and reconstruction of crystalline forms, that as soon as a force like this declares its presence in crystals, it must be placed almost in necessary connection with the forces and actions which bring about the separation and reunion of the molecules. It was therefore to be anticipated that chemical force would and must be reactive here. I hope that it will furnish us with the means of concentrating the force in question, and facilitating further investigations to a greater extent than has yet been accomplished, where I have been almost wholly restricted to the irritability of sensitive persons, and, above all, that it will afford what I have hitherto wanted—a more convenient reagent, and a more certain measure for its relative amount.

151. And now let us turn our eyes back to the magnetic tub; the strange affair loses its mystery: truly at the pain of still greater ridicule. It is merely an accidentally aroused, slowly proceeding, *chemical action*, which gives out the desired force, exactly as a slowly burning fire gives out gradual and continued heat. It is a current of the force of the magnet, crystals, and human hands, flowing slowly from the chemical action, which is thus very improperly called animal magnetism. It is now comprehensible why the "*baquet*," as it gradually becomes inert, acquires new force when stirred up again months after, since new surfaces are exposed to fresh solution; conceivable, moreover, why every new practitioner can make a new medley, and yet always attain the same effect, because it does not matter at all what things they are that act upon one another, if they will only ferment and decompose each other. Finally, we can understand why one who fills a tub with water and glass alone can produce little, another who succeeds him no magnetic effect at all, since glass and water, let any amount of magnetic conjurations be said over them, will not enter into chemical action, &c. All the wonderful superstructure of the magnetic tub, which, from the time of Mesmer, has not a little contributed to render animal magnetism ridiculous, and to expose it to shame, will consequently be cleared away for the future, and any simple, slowly proceeding chemical operation, perhaps best of all an open voltaic circuit, will take its place, by which means the power will be acquired of arranging it stronger or weaker as may be most desirable, with a choice of very varied modifications in the smallest possible space.

152. But the examination of chemical forces leads us into another still more interesting path. It leads us to the source from which, to all appearance, organic life itself derives its so-called magnetic force, to the focus at which the flaming forces are lighted, which emerge from our finger-ends, and, as we shall hereafter see, from still more noble parts of our curious corporeal structure. This is *digestion.* It being proved that a main source of that magnet-like force lies in chemism, in the play of interchanging affinities, while digestion is nothing else but an exchange, a constant separation and recomposition of matters, enduring uninterruptedly so long as we live, under the influence of vitality—it follows necessarily that, like as we have seen in every, even such weak chemical action as the simple solution of sugar, common salt, alcohol or sulphuric acid in mere water, magnet-like force will be uninterruptedly evolved along our intestinal canal, and must be placed by this great organ at the service of the whole organism. But this is not all. The nutriment digested in the stomach, and then elaborated in the intestines, becomes absorbed,

chylified, in its further course, carried to the lymph and blood by countless large and small vessels, here again chemically changed, carried further and further, more and more altered chemically, and thus onward, ever further turned to account in innumerable decompositions as an inexhaustible reservoir of crystallic force, till at last it leaves the body.

153. All that I have just said of digestion holds good, in altered terms, but to the same value, of *respiration.* It impregnates us with oxygen, carries on the blood to every corner of our body, sustains on every hand the universal interchange of substances, and secures to us, as one of its chief products, the animal heat. The so-called animal magnetism stands beside this, comes, goes, flows, and vanishes with it. That which affords heat, the chemical action in the body, affords, also, as we have seen, crystallic force, magnetism, or whatever we please to call this potential essence. The dynamics, which constitute the inmost life, be they material or immaterial, condition one another, are perhaps one and the same in the ultimate analysis; and when they here appear to us going hand in hand, this is but one more warranty that we are on the right track of their pursuit.

We thus obtain explanation whence the force comes which issues in a polar condition from our hands and fingers as from a magnet, whence it is continually renewed, and why it unceasingly flames forth from us. Chemical action, which is infinitely busied in our whole structure, produces, sets free, and delivers it; and when we meet with it, we see it already subject to the laws of its in-dwelling dualism.

154. By one of the most ingenious combinations of profoundly grasped thoughts the present century has produced, Liebig has led us to the conception that all motive force of which we partake is afforded through digestion, all the heat which we possess through respiration; that is, force and heat are the results of chemical action. Though this cannot yet be laid down either in an algebraic formula, or in chemical symbols, although the form of the expression of such a vast idea may be criticised on many hands, yet its profound conception strikes so forcibly on our understanding, finds such a mighty echo in the totality of all that we at present know of nature, that its final triumph stands in tolerably certain prospect. And since nature affords for our maintenance nothing but air and nutriment, we can scarcely imagine otherwise than that she has directly appointed us to draw from air and food all that is necessary to this our maintenance. If, then, for example, it happens, and calculation shows it, that we daily, on the one hand, appropriate fourteen ounces of carbon from the food, and, on the other hand, give it off again by re-

spiration; when we further find that we daily inspire forty-seven ounces of oxygen, and expire just as many ounces; finally, when we find that the carbon and oxygen emerge combined, and this combination corresponds to exactly as great an evolution of heat as we require daily: so much striking testimony is furnished for such deduction, that all scruples must soon prudently submit to be overcome.

155. I regard it a no small warrant of the profound natural truth of my researches, that, as is seen, I have, by a totally different series of observations and deductions, arrived at the same new field on which I now meet Liebig. Chemical action abundantly furnishes the active principle of crystallic force; the human body overflows with this circulating potential essence,—man digests, breathes, decomposes, combines, and interchanges matter, therefore performs chemical action every moment: thus is it not only clear, it is necessary, it is logically inevitable, that man derives that still mysterious force, the existence of which is made known by these researches, from the play of affinities; in a word, from chemism. It is possible to doubt whether the sun lights us, since it is often day while yet no sun is to be seen; I know this well enough, and do not fight against it.

156. As a conclusion to this section, one more practical application, indeed the more welcome to me that it tears up one of the deepest roots of superstition, the most hateful foe of the development of human enlightment and freedom. An occurrence which took place in Pfeffel's Garden at Colmar is tolerably well known, and has been spread about by many published accounts. I will mention the most important points briefly. He had appointed a young evangelical clergyman, Billing, as his amanuensis. The blind German poet was led by the arm by this person when he walked out. This occurring in his garden, which lay at some distance from the town, Pfeffel remarked that every time they came to a particular place, Billing's arm trembled, and he manifested uneasiness. Some conversation about this ensued, and the young man at length unwillingly stated that as often as he came over that spot certain sensations attacked him, which he could not overcome, and which he always experienced at places where human bodies were buried. When he came to such places at night he usually saw strange sights. With a view to cure the man of his delusion, Pfeffel returned with him to the garden the same night. When they approached this place in the dark, Billing at once perceived a weak light, and when near enough the appearance of a form of immaterial flame waving in the air above the spot. He described it as resembling a woman's form, one arm laid across the body, the other hanging down; wavering, erect, or at rest; the

feet elevated about two hands' breadth above the surface of the ground. Pfeffel walked up to it alone, as the young man would not follow him, struck about at random with his stick, and ran across the place, but the spectre did not move or alter; it was as when one passes a stick through flame, the fiery shape always recovered the same form. Many things were done, during several months; parties taken thither, but the matter remained always the same, and the ghost-seer always held to his earnest assertion, consequently to the supposition that some one must lie buried there. At last Pfeffel had the place dug up. At some depth a solid layer of white lime was met with, about as long and as broad as a grave, tolerably thick, and when this was broken through they discovered the skeleton of a human body. It was found, therefore, that a human being had been buried there, and had been covered with a layer of quicklime, as is the custom at the time of pestilence, earthquakes, or similar occurrences. The bones were taken out, the hole filled up again, and the surface levelled. When Billing was again taken there the appearance was gone, and the noctural spirit had vanished for ever.

157. I need scarcely indicate to the reader what I now thought of this history, which has given rise to much discussion in Germany, since it came from the most trustworthy man living, and theologists and psychologists have given it a thousand dreadful interpretations. In my opinion it belongs entirely to the domain of chemistry, and finds a simple and clear explanation in natural science. A human body affords fruitful material for chemical decomposition, for fermentation, putrescence, vaporizations, and play of affinities of all kinds. A layer of dry quicklime pressed into a deep hole, unites its own active affinities with those of organic substances, and gives rise to a long-continued operation of them. Rain water joins from above; the lime first falls into a pulverulent mass, and afterwards, through the rain-water oozing into it, becomes a pasty mass, to which the external air has only very slow access. Pits of slacked lime have been found in the ruins of castles, decayed for centuries, still so well preserved that it could be used for mortar of new buildings. The carbonic acid, therefore, penetrates constantly, but so slowly, that in such spots a chemical process goes on through many years. This event, therefore, had its usual natural course in Pfeffel's garden; and since we know that a constant emanation of the flame of crystallic force accompanies it, this was a fiery appearance, which must necessarily endure until the affinities of the corpse and the lime for carbonic acid, &c., were brought into a state of rest. Whenever a living man, who was sensitive to a certain degree, but might appear to be otherwise healthy, came there and entered into the sphere of these physical forces, he

necessarily would feel, by day, like Miss Maix, and by night, see like Miss Reichel. Ignorance, fear, and superstition, then shaped the luminous appearance into the spectral figure of a human being, and furnished it with arms, head, feet, &c., as, when we like, we may shape every cloud passing over a bright sky into a man, or a goblin.

158. The desire to deal a mortal blow to the monster superstition—which a few centuries since poured from such sources so inexpressible a number of miseries over European society, when, in unhappy trials for witchcraft, not hundreds, nor thousands, but hundreds of thousands of innocent persons breathed out their lives miserably on the rack or at the stake—led me to the experiment of bringing a highly sensitive person, by night, into a cemetery. I thought it might be possible, where mouldering corpses thus lay, to see something of the kind that Billing had observed. Miss Reichel had the courage, unusual in her sex, to promise the fulfilment of my wish. She consented to be taken, on two different very dark nights, from Reisenberg Castle, where she was residing with me, to the cemetery of the neighboring village of Grünzing. The result actually fulfilled my expectation most perfectly. She soon saw a brightness, and perceived along one of the mounds a fine exhalation of flame; she found the same in a slighter degree on a second grave. However, she did not suppose them to be either witches or ghosts, but recognised the fiery appearance from one to two spans high, as a luminous vapor, waving over the graves and extending over the ground, the length of the latter. Some time after she was taken to two large grave-yards, near Vienna, where several burials occurred daily, and the mounds lay around in thousands.

She saw many graves furnished with such luminosities. Wherever she looked, she found herself surrounded by fiery masses. But these showed themselves more particularly over all new graves; while on very old ones they were extinguished. She described the appearance as less like clear flame than a dense vapor-like mass of fire, intermediate between flame and mist. On many graves this fiery light was as much as four feet high, so that when she walked into it, it reached up to her neck. When she placed her hand in it, it was as though she had brought it into a dense fiery cloud. She did not manifest the least uneasiness at it, since she had been accustomed to such emanations all her life, and had seen them produced in countless forms, in a natural way, in my house. I am convinced that all persons to a certain degree sensitive, will see these in grave-yards, and in those very much used always in great numbers, and that this observation may readily be repeated and confirmed. (Postscript, 1847.—Since these experiments, which were made in the year 1844, I have taken five other sensitive persons to grave-yards, in the dark, of whom two were invalids, three perfectly healthy. All these confirmed, word for word, the statements of Miss Reichel, and saw the lights more or less distinctly, over all new graves; so that the fact can no longer be open to the slightest doubt, and may be tested anywhere.) Thousands of ghost stories will now meet with their natural explanation, and thus with their end. It will be now seen, too, that our old women were not so far wrong when they asserted, as is well known, that it is not granted to every one to see the spirits of the departed wander over the graves; for in fact it is only the sensitive who can see in the dark the luminosity of the imponderable effluvia from chemical decomposition of corpses. And thus I hope I have succeeded in tearing down one of the thickest veils of dark ignorance and human delusion.*

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* Again, through mesmerism, we obtain a strong corroboration of a fact, which, until the recent importance given to the poisonous influences of graveyards, would hardly in this country have been credited. Jane M., whose case has offered many striking peculiarities, is a person of a very impressionable nervous constitution. Among other curious phenomena developed in her case, was that of a very powerful agitation and sense of attraction to running water; and this was occasionally so strong, that, in riding in an omnibus along the Bayswater road for a couple of miles, she was, always, for some months, strongly inclined to get out of the carriage and rush towards the water. It has, now and then, required considerable force to remove her from the sphere of the influence of a cistern, where the water was rushing into it through the supply pipes. This tendency to strong attraction by springs, or by water in moving currents, gradually became less; but was succeeded by an alarming sense of sickness whenever she passed the St. George's burying ground in the Bayswater Road. She assured the ladies with whom she lived that she saw blue lights or blue hazy clouds of light over the graves in that ground;—that these were of various heights, some of them high enough to envelope a person who should stand upright on the graves. On the fresh graves the light was more vivid, higher and more voluminous, than on those not so recent. These lights were very attractive, and notwithstanding the sickness they caused, which amounted to vomiting, the young woman had a great desire to go and lie down on the graves. All this I had learned, before I thought of undertaking to supply notes to this work, and I ascertained that no one of the parties had read Gregory's Abstract of Reichenbach's researches, or was cognisant of the facts therein noticed on this subject. My servant George Thacker, now the husband of the young woman, had been in the habit of walking home to Bayswater, from my house, with her. Having heard that he had repeatedly witnessed the phenomena connected with the grave grounds, I requested him to make notes of what he had seen. He has complied with the request, and I subjoin extracts from his statement:—

"One evening last autumn, I accompanied Jane when she had to pass Paddington Church-yard. She appeared at the time well and cheerful, but as we approached the burial-ground, and were yet half a street's length from it, she was uncomfortable and fell into a mesmeric sleep. Not suspecting the cause, I went on, having her on my left arm, my right being towards the cemetery. I could

159. We now come to the domain *of Electricity.*

By a superficial consideration of the foregoing researches, it may here and there seem as if electricity alone, excited sometimes in one

not prevent her from going round behind me and taking my other arm, and then trying to disengage herself from me altogether. I stared, with astonishment, to see her so attracted towards the burial-ground: I could compare it to nothing but the power of a strong magnet over a needle. I recollected that a stream of water had the same power of attraction over her a short time before. We walked on, or rather I dragged her from the ground, and when I thought she was sufficiently recovered, I asked her what had so strangely affected her. She said the dead attracted her; one in particular, lately buried, who had died of a malignant fever; and if I had not been with her, the influence of that body would have drawn her to the grave, and she should have laid down upon it and died, and no one would have been able to remove her till she was dead. As it was, she had taken much of the disorder inwardly, and felt that she should be very ill. I took her home, and was much grieved to hear, the next day, that she had had a miserable night. She continued ill for some days. Nothing remained on her stomach. With her food she brought up what appeared to be the skin of her throat and stomach; and her mouth and tongue, which were parched, and of a white color, peeled off their skin in the same manner. Some time after this she accompanied me into the country, on a short visit to my family, and she was similarly affected on walking with me at the distance of a field's length from the church-yard. Whenever we walked in London, if we came near a body ready for interment, or if we passed the corrupting mass of a burial-ground, it mattered not, the same attacks seized her. At length, determined, if possible, to find a remedy for the evil, I one day put her to sleep and excited her organ of ideality, begging her to endeavor, by the use of her clairvoyance, to point out some means of overcoming the evil. After thinking some time, she told me a small bottle of mesmerized water carried in her pocket, or in her hand, would have the required effect, and would draw all the injurious influence into itself, and she should, for the time, remain unhurt. On trying the experiment, I was overjoyed to find it fully successful; and ever since have been careful to keep her constantly supplied with fresh phials of mesmerized water. Some other person has always to empty these phials, into the earth, at a distance from Jane; otherwise the bad influence escaping from the water would attack her: and if at any time another person should have touched these bottles, Jane can perceive it by the contents looking black instead of blue; and in this case their virtue, for her, is lost. She describes the appearance of this pernicious influence rising from the graves, more particularly of those recently buried, as looking like beautiful blue vapory flames, rising to a great height; or like the mist of a waterfall, mixed with thousands of bright sparkling drops, but all blue. When this bad influence comes over her, she is seized with a violent cough, which lasts until she nearly or quite sinks with the exhaustion produced by it."

Here are materials for reflection on the force yielded by the chemism of dead organic matter. When will man be wise enough to dispose of the dead so that they may be extensively useful to the living? We must hope for good by the progress of intelligence among the masses. I can remember the time when gentlemen, students of anatomy, were obliged to risk their lives in exhumating bodies for dissection. Thirty-five years ago, I had the honor of putting my name, near that of the celebrated Lady Morgan, on a list proposed to be published by Professor Macartney, for the good of mankind, of those willing to cede their way, sometimes in another, bore the greatest share, if it were not the whole basis, of the phenomena which are here detailed. The following results will show what is to be thought of this.

160. The first experiment was for the purpose of seeing what amount of sensibility for galvanism existed in the patients who are highly excitable by steel magnetism. It was undertaken with Miss Nowotny, in the presence of M. Baumgartner, the physicist. I brought in a zinc and copper element of about twelve square inches, between the members of which was placed a piece of linen, moistened with salt and water. The patient took in her hands two German-silver conductors, which were connected with the two electrodes by short copper wires. She did not experience the slightest sensation from the current thus conducted, although it gave a shock with the multiplier. She did not feel the sourish taste of the positive conductor on her tongue more strongly or differently from us who were healthy. I tried Miss Sturmann with a soldered zinc and copper element of nearly four square inches. She found little difference between this element when I placed it between her moistened fingers, and separate pieces of copper or zinc; at most the metals seemed a little stronger then, but hardly decidedly so. Miss Atzmannsdorfer did not feel a similar element, taken in her moistened fingers, any more strongly. Miss Maix could just distinguish the zinc of the element when she held it in her fingers, moistened with salt and water, from free zinc, but this little with no certainty. A large square element of twelve inches on a side she found little stronger, even when her fingers were wetted with a saline solution. Miss Reichel found this re-action just the same as her predecessors; she experienced no observable influence from the union of the zinc and copper into one element, whether this were large or small, her fingers wetted with water, or a saline solution. The current produced in a single element, after the subtraction of the obstacles to the passage, and with the little tension it has, is indeed very weak; but if the re-agent in which it has to act be in a high degree sensible, it is fully sufficient to produce effects. It makes the nerves of frogs contract, diverts the needle, decomposes weak iodide of potassium, &c., and therefore we were led to expect that it would act perceptibly to the feelings upon the nerves of the sensitive.

161. Yet it follows from these experiments, carried out with every care, in every case frequently repeated, all instituted on highly sensitive persons, and all responded to in the same way,—*that a weak*

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bodies for dissection, in order to oppose the ignorant superstition of the age. The glorious Reichenbach has, in this treatise, done good service against the vile demon of superstition.

hydro-electric current in itself does not act observably more powerfully on sick persons, even when they possess a very high degree of excitability by the slightest magnetism, than upon the healthy. This, therefore, proves conversely that it cannot be galvanism, for which exists in them the exalted sensitiveness which we have become acquainted with.

162. Compound circuits, of course, acted more strongly upon them. I brought a little pile of soldered zinc and copper elements, almost four inches square, to Miss Nowotny. The intermediate layers were of felted cloth, moistened with solution of common salt. The zinc surfaces were not very clean, and I let this be so on purpose, so as to retain power over slighter modifications of the strength of the current. I piled up ten pairs before she and others perceived anything at all from it. At fifteen elements she began to trace a little effect, but some of the most excitable of the healthy spectators also already found it. With twenty pairs the tremulous motion from the discharge reached from both hands to the elbows, while I could now feel it myself the length of my finger. Other girls present felt the shock beyond the wrist. Miss Nowotny was, indeed, the most sensitive among us, but did not exceed the usual greater excitability of other healthy persons. With Miss Maix I arranged a pile of nine of the same elements. The result was about the same as the last. The zinc plates were made somewhat cleaner this time; she therefore felt the nine pairs about as strongly as her predecessor had felt the twenty; but healthy persons felt them almost as strongly. A certain degree of increased irritability must be attributed to the general diseased condition, dependent, not upon the sensitiveness, but upon sensibility. With Miss Reichel I tried from two to fifteen elements, in different stages of her disease, on occasions several months apart, in July, September, and November. She did not feel a few elements at all; with from fifteen to twenty she perceived the effect so little, that she never mentioned it when discharges passed through her accidentally, in the course of the operations on the pile; forty to fifty pairs she felt vividly, but she regarded it as sport to take shocks from them when others hesitated to venture. And subsequently, neither on the days mentioned nor on any others, were any results to be observed. Miss Atzmannsdorfer felt no difference between a zinc-copper element, held in her fingers, wetted with a saline solution, and a piece of one of these metals taken by itself; she found the reaction of the copper warmish, that of the zinc rather cooling, but without other notable effect. I applied to her feet three, then sixteen elements, in a circuit. She perceived the electric current just like healthy persons; at length she detected that with the increase

of the number of elements the zinc began to act more coolingly, the copper with more heat, upon her fingers. This was the first trace of the excitement of crystallic forces by the voltaic element.

163. When Miss Reichel allowed the current from fifty elements to pass continuously through her for some time, holding the polar wires in her two hands, the sensations from it increased gradually in strength, becoming felt on the one hand in the head, and on the other extending to the knees; but this was the first character of galvanic action upon her, which necessarily presented itself after a certain time, since a persistent current brings with it as a consequence direct magnetic motion. It was therefore not galvanism alone acting directly here, but because by its entrance it according to known laws converted the conductor more or less into a magnet, which was here the transverse axis of the patient herself; namely, the path from one hand, through the arms and breast, to the other.

164. When I had recourse to the electrical machine, and let frictional electricity strike upon her from the conductor, it amused her; she drew dozens of sparks from it for mere pleasure; no special sensation presented itself distinguishable from those of healthy persons. Subsequently, electric shocks were ordered her by her physician, to be delivered at the nape of the neck, and carried along the spine. I undertook to provide this rough medicament. In accordance with the prescription, I charged to saturation a Leyden jar having about a square foot of coating, and gave her daily eight such shocks, which were not pleasant to sustain. But she did not find anything different in them from what we others should have experienced.

165. The conclusion which I believe these experiments to warrant is, that *an electric discharge, carried through the body, either from the voltaic pile, the conductor, or the Leyden jar, passes over too quickly to allow it to set in perceptible motion the force which prevails in human beings, as in crystals; agreeing perfectly with well-known analogous electrical effects.*

166. However, it will immediately appear that we may by no means deduce from this the conclusion that all other kinds of electrical operations are as ineffectual as the shock or the discharge from a weak pile. When I placed in the patient's hands a thick copper wire connected with a weak pile, and allowed her to become accustomed to it, then completed the circuit with this wire, so that the whole current was made to pass through her, without by any means penetrating into the substance of the hand, she at once felt apparent heat—*i. e.*, crystallic force—increase in the wire. The hand was in this case in immediate contact with conducting wire, and the latter

was so thick, one-twelfth of an inch, that real heating of it was out of the question.

Since, however, the hydro-electric circuit is a complication of chemical, magnetic, and electrical activity, and thus no instructive conclusions could be expected from it here, I directed the observations to frictional electricity, and made the patient enclose a discharging wire from the conductor with her hand, in such a manner that she did not actually touch the metal, but that this passed freely through her half-closed hand. As soon as I set the glass plate in motion, she had the sensation of a warm atmosphere around the wire, which she clearly distinguished from the well-known *aura*.

167. I pass over the experiments on conduction, accumulation, polarization, &c., which are all involved in the following, and hasten to the phenomena of light. I placed Miss Reichel on the darkened staircase, gave a brass wire six yards long into her hand, the point being held free. The rest of it lay on the ground, passing through the door, and ending at the conductor. The machine worked so weakly, that only sparks about half a finger's breadth long could be drawn from the conductor. Soon after the first revolutions of the plate, a slender column of flame ascended from the end of the wire, such as we have already met with in other similar circumstances, ten inches high, about the thickness of one's thumb below, and running up to a very fine point. When I turned the plate rapidly, of which the patient on the staircase could not be aware, the flame rose higher, and sank again as often as I ceased. The point of wire had no visible trace whatever of an electric brush to healthy eyes, which of course was rendered impossible by the many points of delivery that occurred along the wire. As often as I ceased to move the machine, the flame on the wire endured of the same form for more than a minute, and then first began to diminish slowly. An action therefore took place here which did not agree in any way with the known phenomena of an electrified wire. Every repetition, at different times and with change of the wires, always reproduced the same phenomenon.

168. Instead of fastening the wire on to the conductor, I detached it, and applied to the same end of it a hollow polished ball two inches in diameter. I took hold of this by the wire, and approached it to within two inches, sideways, of the electrified conductor, the sparks of which only equalled a tenth part of this distance in length. The ball was therefore placed in the electrical atmosphere of the conductor as soon as the machine was turned, but remained unisolated in my hand. A full minute elapsed before the observer shut up in the dark perceived an alteration at the end of the wire which she held in

her hand; then, however, the flame began slowly to rise before her, above a span in height, and I turned the plate of the machine for four minutes before it, by degrees, reached its maximum, at which it there uniformly maintained itself. When the machine was now stopped and the ball removed out of the sphere of its action, the flame again remained for more than a minute of unaltered size, and then began to disappear, which it did completely within several minutes.

169. I modified this experiment by removing the brass ball to a greater distance from the conductor. I now held it eight inches above the conductor. The observer described the phenomena in the same order and intervals of time; the flame in her hand was now even somewhat larger. I then held the brass ball at a distance of forty inches from the conductor, laterally. The phenomena actually recurred in the same space of time, and only changed in that the flame was now about one-fourth shorter. Finally, I removed the ball eighty inches (more than a fathom) from the conductor, but again, after a pause of two minutes, the flame at the end of the wire on the staircase rose up, increased for five minutes, and when the machine was stopped slowly sunk away in the course of several minutes. This time, however, it only attained half the size.

170. I placed the ball firmly upon the conductor, so that it was no longer in the electrical atmosphere, but directly received positive electricity: under these conditions the same phenomena presented themselves, but now in less than half a minute, instead of not for two minutes. The duration of its increase, however, and the slowness of its subsequent dying away, remained the same as before. When any one touched the conductor with the finger, or took hold of the brass ball itself, during this, the size of the flame was not obviously altered; it came, went, and vanished in the same times, and with no perceptible difference of size. But when, instead of this, I placed the ball so near to the conductor that a rapid succession of sparks passed over to it, the effect was not produced; the observer felt the successive shocks in her hand at the passage of the sparks, but perceived no flame at the end of the wire. The rapidity of the electrical action was so great that the flaming principle, more sluggish than it, was not set in motion. Finally, I repeated all these experiments with negative electricity, the apparatus being in connection with the isolated cushion, which, however, was connected with the earth. There was, however, little, or rather no distinction in the results, on the darkened staircase. In all these experiments not a word was spoken; the observer, who sat in darkness, was separated from me by a wall, and knew nothing of all the various modifications and repetitions, did

nothing but call out, from time to time, like a clock, so loud that it could be heard through the closed door, the changes as she saw them originate, endure, and pass away, on the wire. So that there could be no question of any kind of deception here,—on the contrary, this exact coincidence of the phenomena with the experiments and the theory, was an expressive evidence of the correctness of all the operations.

171. These experiments speak so clearly that I shall pass over the enumeration of a number of others. I have only to add, that all those slender flames which presented themselves in the darkness diffused coolness. When the sensitive girl was near the electrical machine, the positive charge of the brass conductor gave her a feeling of heat; but when she stood some paces distant from it she always experienced coolness. I shall be able to clear up the cause of this distinction in the succeeding treatises.

172. I afterwards brought over the conductor a tin electrophorus plate of about a foot in diameter, on a wooden handle, in such a manner that it was placed, at a distance, in the atmosphere of the conductor, for about a minute. When, having first touched it freely with a wet finger, I brought it near the face of Miss Reichel, she felt coolness issue from it strongly and for several minutes, which seems to confirm, in a different way, the experiments of the preceding article. I did the same also with an isolated body; I suspended the often-mentioned German-silver conductor over the conductor of the machine, by a silk band; its effect, when brought near the face of the patient, was, as might have been foreseen, exactly the same as that of the unisolated tin plate: as yet no isolator has been found for the crystallic force. Similar experiments were also made, with the same results, on Miss Atzmannsdorfer. The same unisolated tin plate was first brought near her face before having been placed in the electrical atmosphere. She felt it as she did most metals, to emit heat. It was now held a hand's length above a weakly-charged conductor, and then touched for a moment with my wetted hand, so that if it should possibly have abstracted any trace of electricity this might thus be fully removed. When I now held it again before her face, I found that it had become remarkably cool, spreading cold around it.

173. In every case, therefore, in which electricity is excited to any permanent extent, that peculiar force appears which I am endeavoring to clear up in these essays, and *accordingly electricity presents the tenth source of it.*

RETROSPECT.

a. Chemism is a widely-comprehensive source of magnetic-like force, both when simple and when produced by combustion and the voltaic pile.

b. The slightest chemical action suffices to produce it abundantly, to charge the vicinity with it, to form polarities, produce light, &c.

c. The magnetic tub is nothing but a chemical operation.

d. Digestion and respiration, and the interchange of matters generally, as chemical processes, are the sources of the magnetic force which exists and acts in the human body.

e. The spectral luminous phenomena which have been observed over graves, but denied to exist by all healthy persons, are really of a purely chemical, physical nature, but can only be seen by highly sensitive eyes.

f. Electricity also is a source of the force which dwells in crystals, &c., both frictional electricity, positive and negative, and contact electricity.

g. Even the electrical atmosphere is capable of setting it in full motion at considerable distances.

SIXTH TREATISE.

THE MATERIAL WORLD IN GENERAL.

147. We have now seen the force we are investigating produced from ten different but always *particular* sources; we will now seek a more *universal* occurrence of it,—we will look for it in the whole material world, and seek to make out something of the great part which it plays in the wide totality of things.

175. Every one is aware that many persons exist on whom particular substances exert a peculiar, usually disagreeable effect, which often seems to border on the ridiculous. I will not speak here of the strange things to which instinct urges pregnant woman. But when we find people who cannot bear to touch skins, others who cannot bear to see feathers,—nay, such as cannot endure the sight of butter, &c., this *may* be regarded simply as a result of defective education; but experience shows that definite antipathies of this kind recur in exactly the same form, and against the same objects, in different persons, and in the most distant countries. This proves that they are by no means always outbreaks of a want of good breeding, but that some equally definite cause, be it of objective or subjective nature, must often lie at the bottom, and that when it occurs it must not be chidingly reproved, but frequently deserves that its origin should be investigated and taken into account.

More accurate observation shows that these strange antipathies, often expressed in a very active manner, present themselves most frequently in those persons who, to outward appearance healthy, are more or less sensitive, and that the degree of their strength and variety increases in proportion as the persons are more diseased, and subject to nervous complaints, spasms, and similar affections. This is so much the case in Miss Sturmann, for example, that sometimes she cannot take hold of a key or bolt of a door, without her fingers being seized with cramps; while, at the same time, she nevertheless walks about the house, garden, or even in the streets, like a healthy person.

In the course of my numerous investigations on highly sensitive persons, I soon became aware that these antipathies had some points in common, that some agreement was to be found, the further tracing and comparison of which could not but afford hope of discovering some relation of cause and effect in the phenomena, and thus possibly supplying the means of penetrating the common, deeper-lying natural cause. I found that certain definite sensations always returned, and that when the feelings of the patients were clearly made out and distinguished by similar names, their apparent multiplicity might be traced back to a few which were continually recurring. And these few I soon found to obey settled rules. They consisted of feelings of apparent heat or cold received from various substances of exactly equal temperature; of more or less decidedly pleasant or disagreeable character, increasing so far as to the production of convulsions, of sensations of pricking, throbbing, or drawing, affecting the skin and extremities, and of painless tonic spasms. In the second of these treatises, where I have explained the character of the force of crystals, I have already pointed out that in the case of Miss Nowotny, the last phenomena, the painless tonic spasms, were produced by the emanations of the poles of the axes of crystallized bodies, and that the capacity for producing this effect was imparted in different degrees of strength to different bodies, but was never wanting in those which are capable of forming free crystals, whether they consist of a simple or any ever so greatly compound substance. This kind of sensation has, therefore, been to a certain extent discussed, and for the present settled: there only remain to be examined, therefore, the sensations of apparent *difference of temperature*, those of *unpleasantness*, and the seeming *mechanical agitations*, of the pricking, &c.: and we will here apply the test to some of them.

Some of these sensations extend to the healthy, but the highly sensitive experience them more strongly or weakly, according to the nature of the disease, and to the standard of exaltation of their sufferings. I was led to the first investigation in this direction by the recognition, in Miss Nowotny, that all amorphous bodies, which are devoid of the peculiar efficacy of crystallized, had nevertheless a reactionary influence of a disagreeable kind, as well as sometimes an additional one of heat or cold,—that this was attached, with a certain constancy, to particular substances, and possessed different degrees of strength in different substances; while, in the former case, the crystallic force seemed to proceed from the kind of condition of aggregation: here something dynamical, of a different kind, showed itself in the matter itself: form and substance, therefore, exhibited a strongly marked difference in their power of affecting external things.

176. As it was evident that something lay hidden here, which must possess either physiological or physical interest, I undertook the

no small labor of testing the sensation of discomfort of the patients, with more than 600 substances; namely, the greater portion of my collection of chemical preparations. It was found that there were in these very clearly marked gradations, and that the patient was able to distinguish these gradations with such delicacy, that she was able to assign to every substance its place between two others. This she could do with such certainty, that when I gave her again on the third or fourth day the substances which she had previously arranged in series, she again placed them in exactly the same places in the arrangement, as she had given them in the first instance; while it is clear here that she could neither recognise or understand anything in this numerous collection of white and colored powders. She had an equal degree of clearness in her feeling, to anything that we meet with in the vision, for the distinction of tints of color, or with the ear, for the distinction of harmonious or discordant tones. When we recollect that, in Miss Nowotny, this feeling had received none of that practice by which the sight, the hearing, and other senses gradually acquire, with constant exercise, their full development and susceptibility in the course of a long life, and of which we have learned, in the psychological field, the overwhelming influence on the clearness and distinctness of sensual perceptions,—some idea may be formed of the extraordinary inner acuteness with which this peculiar abnormal feeling must be experienced; and by which we shall hereafter clear up much that at present lies in complete obscurity.

177. Scarcely a couple of dozen substances had been brought into a series in this examination, when I already saw a law develope itself: the substances became arranged according to their electrochemical values, in such a manner that those standing highest came to the top of the list, the indifferent below, and with a striking disregard of their polar opposition. I will not venture to tire the reader with the enumeration of the whole series of more than 600 substances, but still I wish to select a small number:—the highest, *i. e.*, those substances acting most strongly, were: oxygen gas, sulphur, caffeine, sulphuric acid, potassium, phosphorus, sodium, selenium, iodine, cinnabar, lead, and potass. Between the numbers 30 and 100 occurred —bismuth, arsenic, mercury, morphia, zinc, iodide of potassium, tellurium, chloride of calcium, chromium, lithium, oxide of gold, oxide of nickel, tin, iridium, nickel, alcohol, chlorine gas. Between 200 and 400 came—paraffine, rhodium, acroleine, piperine, creasote, common salt, quinine, brucine, cantharadine, strychnine, anhydrous acetic acid. From 500 to 600—cinchonine, quartz, hippuric acid, mastic, chalk, gum, almost all vegetable acids, sugar, sugar of milk, mannite. At the end of the series stood palladium, platinum, silver, copper,

iron, gold, amber, and water. These last were almost perfectly indifferent to *this* sensitive patient. With the small exception of a few rare metals, which very probably were not perfectly pure, all highly polar bodies appeared at one end of the scale, the indifferent at the other; among which iron, with its magnetic capacities, makes the only exception. Strangely enough, she could make out any distinction between the substances of the positive and the negative pole, in spite of my endeavoring at the end to make her aware of important differences in these, and consequently directing her attention particularly to this. Oxygen gas, sulphur, phosphorus, stood coordinated with potassium, sodium, lead, &c.

178. This task, which occupied a whole week, was performed with the patient in a perfectly clear state of consciousness. I now sought to control it by examinations during her unconscious cataleptic condition. Whenever I laid any body in her motionless hand, it reacted upon her; the indifferent, when not crystallized, left her tolerably quiet; substances occurring nearer to the middle of the series made the hand restless; those bodies past the middle produced trembling and abnormal twitchings in the hand; and when I placed in her hand the highest substances, such as sulphur, caffeine, lead ore, iodine, cinnabar, or even the higher standing minerals, like heavy spar, fluor spar, pyrites, or selenite, the whole arm was seized with such violent cramps that it rose up quite mechanically—just like a frog's thigh through which a galvanic current passes, and flung far away the body held in the hand, and then, in the cataleptic manner, remained outstretched in this unnatural position. These counter-tests prove that the unknown effect of these substances is exactly the same in catalepsy, in their relation to each other, and qualitatively in general, as in the awake condition, but that quantitatively the strength of the action is considerably exalted. What she only experienced as very disagreeable when awake, produced violent spasms in the cataleptic condition. When she recovered, after some time, from these conditions, and regained her consciousness, she invariably complained of pain and deadness in one arm: this was always that one with which the experiment had been tried, of which she knew nothing, and of which she was not informed. The spasms were, therefore, connected with violent excitement and tension, which left behind a state of exhaustion. From all this we have to set it down, that *all solid bodies, in contact with this sensitive person, produced reactions upon the feelings of a peculiar kind, differing in a graduated series according to their different chemical composition.*

179. In the course of these matters, I often made the striking observation, that certain of these bodies began to act, to set the hand

in motion, before I had actually dropped them into it, and while I still held them over it. Devoting some attention to this phenomenon, I found that many substances only required to be laid upon the bed at a little distance from the hand, in order to produce reaction upon the patient. Of this kind were sulphur, lead ore, fluor spar, rock salt, cinnabar, grain tin, selenite, arsenic, salammoniac, prussiate of potash, antimony, telluric acid, wolfram, apatite, celestine, white lead ore, cyanide of potassium, sulpho-cyanide of potassium, orpiment. The hand lying near these began to tremble; this soon increased, and very often became so violent that it approached towards the substance, then dashed this away or became fixed in a tonic spasm. Here, therefore, was distinctly manifested *action at a distance, even of amorphous bodies, providing only that they were of high electro-chemical rank.*

180. To try how these reagents would act upon the sensitive, while conscious and out of the catalepsy, I made the same experiments the next morning, at the hours in which she usually was in the greatest degree of suffering. All the above substances were brought near her hand, but made no impression on her, even none whatever after repeated trials. She herself covered her closed eyes, to be quite sure whether she did not feel anything when those substances were brought as close as possible to the hand, which had produced contractions and cramps the evening before; but it was in vain: not until actual contact took place did those very disagreeable sensations begin which I have described above. *Catalepsy itself is therefore a condition which exalts in a disproportionate degree the sensitiveness of the patient to certain unknown qualities of matter*, and matter possesses some hidden quality, by means of which it affects the cataleptic peculiarly in an exalted degree, *even at a distance*, in a manner analogous to that in which it affects patients in the awakened condition, free from the catalepsy, by actual contact.

181. These observations soon received wider development in Miss Maix. Most of the substances which I placed in her hand affected her as warm or cold, as I have already mentioned; but together with this feeling, which she only received at the touching surface by actual contact, another very frequently presented itself, and this was a simultaneous cooling, like that cool wind which was diffused from many of the bodies I tried (resembling that from the positively electric touch to healthy persons). Sulphur was one of the first of these bodies. When I laid a little piece in her hand, she felt both warmth at the point of contact and a coolness which spread itself all over the hand like a gentle, cool breeze. This soon increased, extended from the hand up over the whole arm, the face, became perceptible in the

other hand, and also seized that arm; then it penetrated through the dress, and was felt on the breast; at last it flowed, through the coverlet, all over the lower parts of the body, and at length even the feet felt the cool emanation which proceeded from the sulphur.

182. I laid the sulphur in an open drinking-glass with a thin bottom, and placed this in the hand of the sensitive. She thus grasped the sulphur without touching it, and was at the same time, at all events in my expectation, cut off from its direct radiation. The drinking-glass, when previously tested, had felt warm, without any emanation. As soon as the sulphur was placed in it, the point of contact of the glass and the hand remained warm, as before, but a cool wind now issued from the glass, on all sides, diffusing itself over the hand. It flowed from all parts of the bottom of the glass which were not in contact with the hand, it seemed to sink down from the sides, and to flow over from the mouth of the glass, thus streaming down upon the hand. This cooling influence, which appeared to penetrate through the glass, was, however, much more agreeable than that coming immediately from the bare sulphur; finer, as if more transparent, the patient said,—purer, and more ethereal. It soon penetrated the whole hand, made it cold, then stiff, and persisted for a considerable time after I had taken the glass away. It had at the same time been felt on the face, the other hand, and the neighboring parts. A piece of selenite, substituted for the sulphur, produced exactly the same effects.

183. When I had removed the sulphur from the glass, and laid it, for the moment, on a tube standing by the bed, in order to perform another experiment, Miss Maix very soon said to me that she could still trace thence the presence of the piece of sulphur. I then removed it to a greater distance, about a yard away; she still perceived its presence. Even at the distance of two yards, she could detect traces of the coolness from a piece of sulphur not larger than one's finger. I now prepared a surface of sulphur, measuring half a square foot, in this way: I sent for six of the sticks of sulphur which are used for branding wine-casks, and fastened them, side by side, upon a board. With this improvised apparatus, held opposite to the patient, I could remove, step by step, the whole length of the room, nearly eight yards, and the observer still felt—weakly, it is true, but distinctly—the so-called cool wind flowing on to her from the surface of the sulphur. At this distance she found the sensation to agree exactly with that which was produced on her by the point of a large rock crystal or small open magnet. The effect of the last two was somewhat stronger, but tolerably similar in its kind.

184. The sulphur produced a sensation of warmth, both in the

immediate contact and when glass was interposed: I therefore sought for some other substance which appeared cold. Concentrated sulphuric acid was one. When given to her in a glass, she felt great cold at the point of contact; but when it was removed, she felt the cold air from the acid at a distance of several paces. Nitric acid was also cold in contact: its action at a distance extended half as far again as that of an equal quantity of sulphuric acid.

185. I had still to seek out some body which was neither warm nor cold, but indifferent, when lying bare upon the hand. I found such in paraffine and cane sugar. Cold wind nevertheless issued from both; from the paraffine to two yards distance, from the cane sugar about one yard.

186. I now went through a quantity of the most different substances with the patient, to collect confirmations and extensions of this phenomenon. A flask of oxygen gas was felt hot, especially when waved about; it soon made the hand and arm stiff and cramped, was in the highest degree disagreeable, and spread a cool wind to the distance of half a yard. A so extremely small quantity of a concentrated substance, in which we yet in part constantly live, had here, as with Miss Nowotny, such a strongly-marked action! I possessed a portion of chromic acid in a glass tube about three quarters of an inch thick, sealed up at both ends. She found it burning hot through the hermetically closed glass, but diffusing cool wind to a distance of several yards. Phosphorus in water like sulphur, only weaker, cooling at three yards. Selenium almost like sulphur, radiating coolness to six yards from some small fragments. Tellurium behaved very like sulphur, but gave a cold wind the whole length of the room. Charcoal had the same properties in disproportionately weaker degree. An empty drinking-glass felt warm to the hand, without any wind. When covered with a watch-glass, however, a cool breath flowed down from the glass over the hand; when the watch-glass was removed, the cooling again ceased. It was therefore the enclosed air which produced the cold to the hand. I modified this experiment in various ways, but it always yielded the same result. The oxygen of the air somewhat warmed, when at rest, by the hand, here acquired some little excess of free force over the outer cold and moving air; and since the oxygen always acted strongly here—nay, is even far the most active of all bodies, the very slight elevation of temperature, the effect of which we have already become acquainted with (§ 177,) was sufficient to produce a perceptible manifestation.

187. Almost all the metals felt warm by direct contact, but at the same time all diffused emanations of what the patient called cold wind. They follow one another, in the order of decreasing strength,

about in this manner: chromium, osmium, nickel, iridium, lead, tin, cadmium, zinc, titanium, mercury, palladium, copper, silver, gold, iron, platinum. A plate of copper of about half a square yard surface, placed near the bed of the patient and opposite to her, produced a lively, cool, fresh wind, which gradually appeared to flow very agreeably through the whole of the bed. A zinc plate of equal size produced the same effect less strongly. Still weaker was the action of a lead and an iron plate. But when I placed before her a quicksilvered mirror, at first with metal coat next her, this worked very strongly upon the observer; the glass side of the mirror, however, acted still more strongly, the emanations from this being again that fine, altogether agreeable coolness, which we became acquainted with above (§ 182,) when the effects of sulphur and selenite were conveyed through glass; the patient felt herself imbued with the agreeable feelings from head to foot.

188. I instituted less extensive experiments with Miss Sturmann, but the few were decided enough to afford positive confirmation. Oxygen gas was found very hot in contact; sulphur, selenium, iodine, bismuth, chloride of gold, iridium, oxide of gold, and morphia, were all found warm in contact with the hand; antimony, mercury, zinc, copper, tellurium, lunar caustic, bismuth, gold, lead, tin, and iron, appeared cold in their different gradations. Potass gave an uncertain result. Crystals of calcareous spar, double spar, arragonite, tourmaline, and rock crystal, were polar, warm at one end and cool at the other. I tested with her surfaces of half a square foot of sulphur, lead, zinc, copper, silver, and gold; and all these substances she found to radiate either hot, warm, tepid, or cool emanations, at distances of a yard and more. Palladium diffused a fine cool wind, which issued from it on all sides. When I went to her during attacks of catalepsy, and placed in her hand sulphur, selenium, tellurium, mercury in a glass, antimony, or zinc, she struck out, as Miss Nowotny had done under similar circumstances, (§ 178,) and threw the objects away. But when I laid them near her hand, without touching it, this began to tremble and shake, and gradually became contracted, and in some degree cramped; thus exactly as in Miss Nowotny, § 179.

189. Miss Atzmannsdorfer found a cold feeling from sulphur, selenium, pyrites, antimony, zinc, lead, Egyptian jasper, common salt, alum, potash, and brucine; on the other hand, platinum, silver, ironbar, copper, gold, and mercury, warm. A cool wind was diffused to her from some distance by selenite, fluor spar, pyrites, alum, tellurium, lead, common granite, and gallic acid. The wind seemed to her to flow out from all sides of the objects.

190. Mr. Schuh found fragments of sulphur and powder of it

equally warm on contact. Oxygen, iodine, bromine, kupfer-nickel, cyanide of gold, cyanide of potassium, he found warm, and quickly exciting head-ache, which gradually increased to an insupportable degree. He arranged a small number of minerals according to his feeling of the progress from cold to warm, in the following order:—pyrites, fluor spar, calcareous spar, iron glance, staurolite, rock crystal, tungsten, Schörl, sandy calcareous spar from Fontainebleau, heavy spar, topaz, common salt, analcim, and felspar. On sulphate of copper and carbonate of soda, he found points from which coolness seemed to issue. To guard himself from any possible delusion, he had them wrapped in paper, and then tried whether he could find the cool places again in these envelopes. When he opened them he was fully satisfied that he had found out exactly the same points again. He felt distinct coolness to issue from sticks of brimstone, at a distance of ten inches, as also from a little layer of oxalic acid; on the other hand, warmth flowed to a similar distance from leaves of eight square inches surface of tin, lead, copper, silver, and gold.—Silver and gold money also, and steel instruments, were warm to him, when held at some distance above the hand. He could not bear to stay long before a large *cheval* looking-glass, extending down to the ground; the emanations from it soon affected him with head-ache, stupefaction, then with pain in the stomach; when he went to the back of the mirror, the disagreeable feelings seized him much more quickly. Two hours later he tried the same before a large mirror attached to a wall; all the same discomfort presented itself still more quickly and strongly.

191. Mr. Studer surrounded with his hollow hand a number of substances, or held them near to his eyes, with which he was far more sensitive than with his hands, since he could well distinguish coolness and warmth. In this way he felt, without contact, coolness from sulphur, pyrites, selenite, tellurium, chloride of calcium, sulphate of oxide of iron, sulphuret of potassium, oxalate of potass, Seignette's salt, rock crystal, and sugar; warmth at a distance from gold, silver, copper, tin, lead, zinc, potassium, and solution of potass.

The joiner Klaiber felt sulphur, sulphuric acid, selenite, rock crystal, &c., cool at a distance of ten inches; on the other hand, gold, silver, copper, tin, zinc, lead, solution of potass, &c., warm.

I led many other persons who visited me to these objects, and made some of them go through them by way of test; in the end, I regarded two selected substances as the representatives of all the rest, and of the two principal classes of these, namely, sulphur and gold, I kept by me a surface of each about six inches square. Every one whose hand I placed above these at a distance of about three-quarters of an inch, declared, almost without exception, that the sulphur evolved coolness and the gold warmth. I have permission to name some of these persons. M. Kotschy, the well-known oriental traveller, felt a very marked cold from the sulphur surface, and warmth from the gold leaf. Without knowing anything about it, he complained of a strange pricking which the sulphur produced in his hand, although he did not touch it. Dr. Fenzl, the well-known distinguished botanist, felt the distinction of cold and heat between the two bodies very clearly. Mr. Incledon, an English private teacher in Vienna, not only experienced the same in a very lively manner, but described the pricking which the sulphur gave him as very similar to the sensation when the hand is recovering from what is called being *asleep*, and gives only isolated, scattered pricks.

192. Up to this point the phenomena exhibit a mass of variations; but among these inconstancies something very constant is seen to exist. The alternation of heat and cold appears inconstant in substances of one kind with different observers. This part of the subject requires a special investigation to clear it up more exactly. I therefore exclude it from the present treatise, keeping it for an early task, and here only lay down the general but constant *fact, that all the substances subjected to the trial reacted with apparent differences of temperature upon the sensitive persons, without respect to being cool or warm.*

I next succeeded in bringing these phenomena more clearly to light than with any of the former witnesses, with Miss Reichel, and in making them so clear, that all that I have said about the other sensitive persons might be passed over, were it not that observations of the kind can, from their nature, only acquire stability by a greater number of repetitions of the most varied kind. Miss Reichel consented to come and pass some time here at my country residence, Castle Reisenberg, near Vienna, and thus gave me an opportunity of carrying out numerous experiments, with the help of physical apparatus, in a much more regular and complete manner, than could be done in strange houses and sick-chambers, often under very inconvenient circumstances.

193. In order to render the following experiments comprehensible, I must give some little account of the localities of my residence, in which they were made. The castle, as it is called, is so built, that in front there are two rows of nine rooms, connected with one another by doors in a straight line. Each of the rows is about fifty-three yards long, and ends at both sides with balconies, each of which are about ten feet broad, giving together a length of twenty feet; so that since the doors to the balconies are in a line with the doors of the

rooms, a straight space of nearly sixty yards can be obtained for experiment, in a place where the air is calm. Working with wires which require to be held at some distance, the length of the line may be doubled by means of the other series of rooms; thus giving convenient use of almost 120 yards. I placed Miss Reichel at one end of this line, and began to experiment with her on the extent of the action, at a distance, of the substances. With a small horse-shoe magnet of about two and a half inches length of limb, it was necessary for me to remove more than eight feet from the observer before the action upon her began to decrease. With another horse-shoe magnet, eight inches long in the limbs, and about one and a half inch broad, I was obliged to remove to a distance of twenty yards from her. A heavy nine-fold horse-shoe, which at that time would support about forty pounds, required me to go thirty-three yards from the observer, therefore to six rooms off. Comparative experiments with a magnetic rod of forty-two inches long, afforded as its distance of action on the patient, for the positive (southward) pole, twenty-six yards; for the negative (northward) pole, twenty yards.

194. In the next place, I wished to examine the iron rods which served, in a wooden case, as a parallelogrammatic armature to the last-mentioned magnet. One of these was quite like the magnetic rod itself in shape and size; the two others were of the same sectional magnitude, but each only about one-fifth part of the length.—When approached to iron-filings they exhibited nothing, and behaved merely like unmagnetic iron; but the sensitive patient, nevertheless, felt the large armature—

One end at	26	yards.
The other end at	22	"

The cross pieces—

One end at	9	"
Both together at	17	"
The other end	12	"
Both together	28	"

The simple armatures, therefore, acted nearly as strongly upon the patient as the magnetic rod itself, and must, therefore, be placed almost in the same rank for crystallic force. Any delusion, which might be suspected from this surprising result, is out of the question, since it was impossible that the observer could distinguish at the distance whether the object was a few yards nearer or further off, and the results all harmonize under a common point of view, and are thus controlled.

195. Three days later her excitability became much increased with the

advent of menstruation. I repeated the measurement of the distance at which the patient was affected by the magnet. But it was necessary now to make use of all the rooms and both the balconies, and after I had used up the sixty yards of my rectilinear space, she felt the effect of the large nine-fold magnet still so vividly, that she estimated that double the length would hardly suffice to reach the limit of the sensation. I now tried the half-square foot of brimstone. It had affected Miss Maix at a distance of eight yards, but the length of the chamber did not allow of its being removed to a greater distance in that case. Here, however, the sulphur now produced a sensation of cooling at a distance up to forty yards. Astonished at this, I tried a copper plate of about four square feet of surface; the effect of this extended, as warmth, to thirty-one yards.

An iron plate of six square feet gave warmth at a distance of	49	yards.
Lead foil, such as is used for packing tobacco, six square feet	25	"
Tin foil, six square feet	23½	"
Zinc plate, six square feet	21½	"
Silvered paper, pure, one square foot	7¾	"
Gold paper, pure, three square feet	28	"
An electrophorus cake of about sixteen inches diameter	83	"
A common mirror containing about ten square feet of surface	35½	"
A small flask of oxygen gas	6	"

A quantity of other things,—brass objects, porcelain vessels, glass work, stone tables, bright-colored wooden plates, outspread linen, open or closed flaps of doors, chandeliers on the ceiling of the room, entire trees, approaching human beings, horses, dogs, cats, pools of water, especially when they had been shone on a short time by the sun; in short, all and everything that presents itself as material in space, acted upon the sensitive girl, flowing either as a cooling or warming influence on her,—in many so strong that it attracted her attention and became burdensome, in many so weak that when she had become accustomed to it she thought no more about it.

196. This extraordinary phenomenon, where a human being became distinctly aware of the presence of a bit of metal plate, a couple of leaves of gold, or a piece of tin foil, without seeing it, at a distance of a hundred paces, was so astonishing to me, that I could not repress my great amazement, which, however, only produced a laugh from Miss Reichel, who had been accustomed to all this, without interruption, during her whole life. All my sensitive patients, sick and healthy, had, without exception, experienced the same sensations and perceptions, under favorable circumstances, more strongly or more weakly, in a wider or narrower extent, according to the subjective excitability of the individual. Apparently all this was nothing else

than a manifestation of the often-mentioned so-called crystallic force in a—perhaps modified—more general form, and the conclusion which was drawn above (§ 178), from the investigations with Miss Nowotny alone, now obtains its extension and validity for all the persons subjected to the trial:—namely, that ALL *solid substances, in contact with sufficiently sensitive persons, produce reactionary sensations of a peculiar kind, differing in degree according to their different chemical composition; that these reactions are principally expressed in apparent differences of temperature, such as cool and tepid, with which a sensation advances by more or less equal steps from pleasant and disagreeable; and that finally these reactions have every resemblance to the sensations which are produced by the force of crystals, magnets, hands, &c.*

The essential matter now, in order to demonstrate the identity of the cause with the crystallic force, is to investigate the rest of its characteristics.

197. Is this universally distributed force transferrable from one body to others? capable of being accumulated, as I have often expressed it, without by any means intending to pledge myself to regard it as material? I made a strange first experiment, which led to the answer to this question, on Miss Maix. She received a visit from her sister, Miss Barbara Maix. The latter was healthy to outward appearance, but suffered from a variety of nervous affections. She took the hand of the patient, but had not held it long before she let it go again, suddenly, with a shudder. "What in the world have you in your hand that pricks me so?" she cried. There was nothing there. Immediately before this the patient had been holding a piece of sulphur in her hand. This pricking was repeated as often as the hand was reached out. And when it gradually died away, it could be renewed, at will, by the patient holding a piece of sulphur again in her hand for some time. This shows clearly that the imaginary pricking, which subsequently presented itself very often, was nothing else than a transfer of certain unknown qualities of the sulphur into the hand which held it, and which were then reflected to the second hand possessing the same excitability for sulphur and similar things. When I myself grasped sulphur for some time in my hand, and, after a pause, took Miss Maix's, she experienced the pricking sensation from me, and recognised what I had previously held.

198. This was shown more distinctly by experiments derived by reasoning from the above. I placed the German silver conductor in Miss Maix's hand, and allowed her to become accustomed to it in the usual way. I then made her lay it down anywhere, and placed a piece of sulphur upon it. After some minutes I again took this

away, and allowed the sensitive girl to grasp the conductor again. She immediately recognised acutely the feelings which the sulphur always produced in her, and *therefore* something had passed from the sulphur into the conductor, became fixed there, allowed itself to be carried forward by the conductor, and reacted upon the hand of the sensitive.

199. The experiments with Miss Reichel gave exactly similar results. In the first place, I repeated with her the hand experiment of the sisters Maix, without telling her anything about it. I took a roll of sulphur in my hand, and grasped it for five minutes. I then laid it down, and with this hand took hold of that of Miss Reichel. I had not held it long, before she cried out, and complained that my hand was full of needles. She experienced the sensation of innumerable fine prickings all over the surfaces in contact,—an exact confirmation of Miss Maix's observation by the hands of two other persons, and thus a striking proof of the extent to which objective reality lies at the bottom of these phenomena. This hand of mine, which I carefully kept from touching anything else in the meanwhile, had not become pure again, after a full quarter of an hour, but felt prickly still, though in a weaker degree. It had therefore, received an accumulation of the force of the sulphur, which it retained for a considerable time, and which it lost very slowly.

I placed a pair of steel scissors, which she simply found warm, upon some sulphur, and let her take hold of these after some time. The scissors had now become cold, and pricked the hand of the observer, as above. I took a glass tube, forty inches long, which was very slightly warm to her, touched one end for a minute with sulphur, then took it away and gave the other end to the sensitive girl to feel. She now found this very cool; after five minutes, I let her take hold of it again; the coolness was diminished, but still existed distinctly. After the lapse of half an hour the glass was felt again, and had again acquired its original slight degree of heat. Sulphuric acid applied in a similar manner to another glass tube, not, however, brought immediately in contact with the tube, but with the interposition of the side of the glass bottle, had the same effect.

Caffeine, in quantity not more than a few hundredths of a grain, placed in a small thin glass tube, and after a short time taken out again, left the tube considerably warmed.

My young daughter O. laid one hand, which had been tested previously, for a short time upon a number of layers of gold paper, and then gave it to the patient. She found its warmth greatly increased. Felt again at the end of three minutes, she found half of the warmth-exciting cause still in the hand; but after seven minutes there was none, and the hand had regained its natural condition.

A glass full of powdered gum, itself weakly cooling, was placed close beside a bottle containing potassium in naphtha, which belonged to the strongly warming bodies. After the lapse of a few minutes it gave a sensation of alternating cold and heat; it seemed as if a part of the gum had been overpowered by the potassium, while the rest, perhaps the inner portion, was not affected in the given time.

Gold leaf always gave her warmth in a strong degree. I placed an empty glass bottle, which by itself she found cool, upon the gold leaf,—pure, be it understood, not the alloyed, which generally occurs in commerce. I turned it about on all sides, from time to time, to make contact at all parts. I then made the observer grasp the bottle. She no longer found it cool, but very remarkably warm. The gold leaf had inoculated the glass with its warming quality.

I held selenite, itself cold, for some time in my right hand; it did not notably alter. Enclosed in my left fingers, it acquired the power of giving out warmth. Oxide of copper in a glass bottle, cold by itself, underwent a similar change in my left hand.

I placed potassium in naphtha, warm by itself, in close contact with a quantity of fragments of sulphur. After some minutes it had become perfectly cold, as cold now as it had been warm before. The sulphur had therefore not merely removed the apparent heat of one of the strongest bodies, but so overpowered it that in addition it had implanted in it its own peculiar coldness. This accumulation also manifested a duration of several minutes after the separation.

The German-silver conductor, itself slightly warm, was placed in common salt. After a short pause it came from it cold. Fluor spar was then laid upon it; this made it still colder. I next covered it with abundance of bits of sulphur for a minute; again, when it had been taken out, it presented an increase of its coldness.

Finally, a roll of sulphur was applied against potassium for a short time. After the separation it was observably less cold. Left longer in contact it became cold and warm, simultaneously, in different parts. Then, laid upon my left hand for some time, it completely lost all its coolness; and when I at last enveloped it in the gold leaves, and kept it there for a while, the roll of sulphur even became hot.

200. Miss Atzmannsdorfer always found copper rather tepid. One day, however, that I gave it her to try, she said that she felt it cooling. This was in opposition to the earlier observations; I therefore waited a moment to seek what might be the cause. The copper was a thin, smooth plate, and lay upon a polished table of walnut-wood.

I made her feel the table, on different parts of the leaf, of the edge, and of the feet; she found it cool in all parts. I took the copper plate away, and left it for a while on a seat cushioned with silk stuff. When she again took hold of the copper she found it tepid, as all other copper always was. I now placed it on the table again; at the end of five minutes she found it cold again. I stretched the copper between the cheeks of a little vice; after a short interval it felt warm again. Whenever it was brought back on the table for a little while it became cold again. It was evident that the great mass of the cold-reacting table overpowered the magnetic heat of the weak copper plate, and the latter became cool, by accumulation of charge, every time it was involved for a certain period, in the sphere of action of the walnut-wood. By a great number of experiments, therefore, I established, that *the property of bodies here in question may be transferred from one to another by mere contact, exactly like the so-called crystallic force.*

201. We have already become acquainted with the power of acting at a distance, in the magnet, crystals, the fingers, the heavenly bodies, &c., exercised by the force under discussion; we have even seen matter in general exercise it on the cataleptic Misses Nowotny, Sturmann, and Atzmannsdorfer; also on Miss Maix and Miss Reichel in the free, conscious state: the question now arises, whether the force is, in like manner, capable of transference from one body to another, at distances, without contact? To decide this, I placed beside the German-silver conductor a roll of sulphur of equal length, at a distance of three-quarters of an inch, without contact at any point. After a few minutes the sulphur was removed, and the conductor grasped by Miss Reichel. It was warm before, but now she felt it perfectly cold, as much so as if it had been in immediate contact with the sulphur. At the end of four minutes it still retained almost half its coolness, which did not wholly disappear under a good quarter of an hour.

Sulphate of copper, broken small and in paper, was laid beside the broad 40-inch glass tube, at the distance of ten inches, all contact being avoided. In five minutes it was taken away, and the tube taken hold of at both ends by the sensitive observer. In spite of this relatively considerable distance, she found the glass to have been rendered cool by the sulphuric acid salt; and this persisted several minutes.

I learnt from these experiences that I must avoid using my own hands in these delicate experiments, on account of their magnetic power, to guard against any complication; at the same time I recognised here hints for the explanation of many anomalies in my previous researches, wherein my sensitive observers so frequently did not agree together in their statements of heat and cold: it might often have been my own hands which altered the natural condition of bodies, by conveying their own force on to them. On this account I let my daughter H. place her hand in that of Miss Reichel, and accustomed the latter to it; then held the same hand over a surface of sulphur, without contact. At the end of two minutes she offered it to the observer. That needle-like pricking which actual contact with sulphur had produced in all the other cases, immediately presented itself in the hand, together with coolness. The same experiment was made with the same results by my daughter O. The patient experienced the pricking from the hand of the little girl that had been waved over sulphur, at the end of half a quarter of an hour. I pass over other similar experiments.

202. This proves, that *the transfer of the often mentioned essential force from one body to another is effected without contact by the mere approximation of them toward each other.*

203. The conduction of it through other bodies is certainly sufficiently demonstrated by all the preceding experiments; but I will here insert a couple of remarkable confirmatory examples. I connected Miss Reichel with a copper plate by an iron wire thirty-three yards long and one-twelfth of an inch thick, she holding the other extremity in her hand. I brought successively on to the copper plate, zinc, tin, lead, gold, mercury, potassium, potash, potash ley, and minium; all delivered warmth to the hand through the plate and along the wire after the lapse of half a minute; on the contrary, sulphur, carbon, oxalic acid, aqua regia, sulphate of iron, and common salt, gave cold in the same space of time. The sensation likewise began to vanish after the interval of half a minute, when the objects were removed, and required several minutes for its complete disappearance. Sulphur gave a sensation of cold when only brought into the neighborhood of this long conductor. The German-silver conductor alone, laid upon the copper plate, gave warmth; but when I previously kept it for a few minutes upon sulphur, and then brought it upon the copper plate again with my right hand, it gave a persisting cold. I rolled up an empty glass bottle, which by itself delivered slight cold (different glasses always varied between cold and warm), for a few minutes in gold leaf; freed from this, and brought with my left hand on to the copper plate, it delivered lively warmth to the distant hand of the observer. Taking a large glass tube forty inches long, and wide enough to admit the hand, I introduced, one after another, a quantity of chemical preparations of the most varied kinds, solid and fluid, together with the glass bottles containing them. The

sensitive patient described, as occurring at the other end of the tube, which she held in her hand, sensations exactly the same, in order, as those I had marked down from her in the earlier experiments, with the immediate contact of them with the hand. In another way, I gave her a thin glass stirring-rod like a thermometer tube, but solid, between her fingers, and made her dip this, in order, into the contents of many glass bottles of amorphous chemical preparations of all kinds. Her account of the sensations produced by the glass rod in her fingers, agreed, word for word, with those on the broad glass tube; so that a rod of this kind affords the most convenient of all means for the purpose, as dry, fluid, volatile or bad-smelling things can be tested with it, as to their magnetic value, rapidly and without the least difficulty. Miss Maix also furnished me with a few proofs referable here. I had connected a copper plate with her hand, by means of a copper wire. As I placed upon its surface, partly immediately, partly in bottles, sulphur, sulphuric acid, selenium, sugar, silk, wet linen, &c., she described, successively, the same sensations as she had experienced when she had the same substances immediately in her hand.

My daughter Ottone gave one hand to Miss Reichel, and held the other over a surface of sulphur, without touching it. After the lapse of half a minute the latter found the hand of the former become cold; and at the end of a whole minute the pricking sensation from sulphur, already often mentioned, made its appearance. An hour later this experiment was repeated, with the modification that the hand was held over a number of layers of gold leaf instead of sulphur, this time also with careful avoidance of contact. At the end of about half a minute again, a sensation of warmth passed from the hand of the healthy person into that of the patient, which continued to increase for a minute, and then remained steady.

204. All this testifies that *the force which emanates from amorphous substances of all kinds, is conducted and carries its efficiency with it through matter of every kind, even through living human beings; nay, that this holds good not only in case of actual contact, but even with mere approximation of one substance to another.*

205. Capacity of accumulation, coercive power, &c., need no further illustration, since these are already discussed by implication in the foregoing.

206. Consequently only the luminous phenomena remain to be *tested.* These have actually shown themselves convincingly enough. When I undertook experiments on the luminosity of crystals in the dark, with Miss Reichel, she led me to notice, by remarks upon the bolts of the doors, the fastenings of the windows, and other metallic

objects of which she spoke, that she saw all such things. When I brought a freshly-cleaned copper vessel to her, I accordingly heard that she saw it luminous all over, and that a fine green nebulous flame waved immediately above it, streaming out beyond the borders of the copper. I at once undertook a long investigation of this, which I continued and repeated for confirmation at different times, partly in Vienna, partly here, in my summer residences. From this it resulted that all metals, generally speaking all simple bodies, without any crystalline condition, appeared luminous in sufficient darkness to the eyes of the highly sensitive; that compound bodies do also, but weaker and weaker the more complex they become. To test this on different sides, I brought a great number of things into the dark, one after another. Miss Reichel saw the substance of most metals with a red luminosity, as if glowing; some of them white, some yellow. Over all waved a delicate flame, which moved backwards and forwards over them, was of different color in different metals, but was definite for each, and could be driven about by a current of air caused by the hand or the breath. The more complex bodies only exhibited flames at their points, when they were crystallized, otherwise they were mostly either surrounded by a luminous vapor, or even only themselves bright and luminous, as if glowing. The darkness gave me an excellent opportunity of controlling the statements rigidly. I brought to her in the dark, at different times, different, and then, alternately, again the same substances, which no one could recognise in the dark, and it was necessarily clearly manifest in this way whether her later statements agreed with the earlier. This was perfectly the case in reference to the luminous phenomena generally; their strength and their form; also on the simple substances, in reference to their color; but not quite so in the more compound. The color of the luminosity appears, like that of the flame of combustion, to depend upon the quality of the matter from which it issues, and upon every significant intermixture. Miss Reichel always found the following substances alike, as often as I held them before her in the dark :—

Copper plate, red luminous, with green flames over the whole surface, particularly at the borders, flowing over the breadth of three-quarters of an inch to an inch and a half, the flames rolling in from the middle toward both sides.

Iron plate, red luminous, the flame of the entire surface rolling in toward the middle, and somewhat elevated there, half a hand high, brilliantly playing in red, blue, and white.

Bismuth, red luminous flames, and marginal flames bluish-red.

Zinc plates, pale red luminous, the flame opaque-white, reddish-blue at the points, jagged at the edges, uniting into a tuft at the corners.

Tin, cuttings of tin foil, flames dirty bluish-white, streaming out weakly at the edges, with tufts at the corners.

Lead, blue luminous, flame dull blue, little weaker than the tin at the borders, without tufts at the corners.

Cadmium, white, somewhat bluish flame.

Cobalt, weak blue.

Silver, upon paper and burnished, white luminous, flame white, a finger's length high, not rolling together, the same at the borders as in the middle, without tufts at the corners.

Gold, upon paper and burnished, white luminous, flames white, two fingers' length high, not rolling together, border like the middle, no corner tufts.

Palladium, strongly blue luminous, with a pale blue vapor.

Platinum, white luminous, with pale-blue flames.

Antimony, white luminous, with bluish flames.

Rhodium, red, with pale yellow.

Tellurium, red luminous, white at the border, no flames.

Osmium, red luminous, with greyish red vapor.

Mercury, red luminous, with strong white flames and white vapor.

Chromium, green, passing into yellow.

Nickel, red, rising up to greenish yellow.

Titanium, brilliant red, passing into violet.

Arsenic, blue-red, pale red vapor.

Iridium, blue luminous, flames reddish blue.

Sodium, red luminous, flames dull white, towards lilac.

Potassium, red luminous, yellow-red on the cut surface, flames large.

Charcoal, red luminous, red marginal flames.

Diamond, flames white, blue internally, upper points red.

Iodine, red luminous, when shaken passing in some degree into green.

Selenium, bluish red, flames blue.

Sulphur, flames blue, with opaque white vapor.

A glass box set with silver fittings appeared to the observer as if full of fire at night; white flames flowed from the whole frame-work all over the surface.

All these results I found always the same in numerous trials, when the darkness was perfect: when this was imperfect, however, slight variations of the appearances occurred, bluish red became blue, and the like. On the other hand, the colored luminosities did not agree so completely in compound bodies, often even varying, and therefore I can give no account of them until I have subjected them to fresh and more fundamental trials. In particular, the same alkaloids, prepared by different hands, often presented essentially different colors in their light, which apparently depended, therefore, upon their different degrees of purity.

In general these lights and flames had always something of electrical light, so that the color, which like the latter, varied about between red, blue, green, and yellow, was frequently very difficult to determine with accuracy. It had every resemblance of aspect to the magnetic and crystallic flame, and was regarded by the observer only as a lower degree of those to her so well-known appearances, to which she had been accustomed from her childhood, and of which she, at the advice of her dead mother, had hitherto never communicated anything to any one, for fear of being regarded by other people as supernatural and haunted.

207. It follows, consequently, *that all fluid and solid, therefore all bodies of any density generally, give out emanations of light in the form of flames, appearance of glowing, and vaporous luminosity*, in the same manner as the magnet, crystals, &c. &c.

208. In order to complete these examinations of the whole of material things, it was necessary to turn a glance to the starry heavens. We have seen in the fourth treatise the important influence exercised by the sun and moon; this necessarily led me to the idea of investigating whether all the stars which shine in the heavens, collectively, were wholly without action, and whether some weaker display of force, proportionate to the distance, which possibly might be detected in a smaller degree, might not perhaps correspond to the mighty influence exercised on our planet by the former larger and more proximate heavenly bodies.

209. At the windows of my dwelling, which afforded an uninterrupted prospect toward the east and south of from twenty to thirty miles, where I placed Miss Reichel at night, when the sky was clear, she at once recognised an undoubted influence, as I had conjectured. I repaired with her at eight o'clock in the evening, in the middle of October, to the neighboring free mountain heights, where there was a wide prospect all round. There was no moon, and the air was perfectly still. She found coolness to come to her from some parts of the sky, and warmth from others. This was repeated on different nights and at different hours; soon after sunset, then at nine o'clock, P. M., twice at midnight, once in the morning about four o'clock, and just before sunrise. Generally speaking, she stated that soon after sunset, namely at six o'clock, the direction toward the west was most vividly cold; but just before sunrise, likewise at six o'clock, the direction toward the east; that long after sunset, about nine o'clock, north and north-west were the cooler, south and south-east the warmer parts of the sky; but some time before sunrise, about four, A. M., north and north-east were the cooler, south and south-west the warmer directions; lastly, that at midnight the north was cool, the south warm, but east and west so nearly of an equal apparent temperature, that the east could only be felt a little warmer than the west. An observation which was to have been made between two and three, A. M., but which did not take place, would most likely have given east and west pretty nearly of equal temperature.

210. This alternation of the results was evidently an effect of the place of the sun. We know from the fourth of these treatises, that

the rays of the sun give out cold wherever it was nearest; the west in the evening, the east in the morning, the greatest coolness always existed; at midnight, when the sun was in its lower culmination, the difference was almost effaced; but there still remained some after-effect of the sun in the west, which it left behind up to that time, and a complete neutralization was not to be expected before three o'clock, A. M. That this alternation between east and west is really to be ascribed to no other cause, is proved by the observation that these sensations developed themselves just in the same way when the sky was covered with clouds. In all these cases, however, the north remained constantly cold, the south warm; and when I questioned her minutely as to the direction of the two, she always pointed with her hand in the direction of the magnetic, and never of the astronomical meridian. In particular, she asserted that a clearly defined streak of the greatest warmth was to be detected towards the south, projecting itself from the remaining space. Even at noon she found the direction of the magnetic south the warmest, and the diametrically opposite, that is, the north, the coolest of all the points of the compass. This affords a clear index how these results are to be interpreted in a theoretical examination of them.

211. But these half telluric, half solar phenomena, must not be confounded with the astral, with which they are complicated in our sensations. When I stood at night with Miss Reichel, under a bright starry sky, she described the milky way as affecting her distinctly with coolness; as also the group of the Pleiades, the region of the Great Bear, and others, and the broad starry vault in general as cooling; particular stars alone, on the contrary, warm: these were always stars of the first magnitude; and when I examined her about them with the dyalite, I found Saturn with his rings, Jupiter with his four Satellites, Venus,—in short, in every case a planet. Experience, therefore, shows that all stars with reflected light appear warm to the sensitive, while all others with proper light are cool. This ranges itself, then, very beautifully with the experiments made before, when the moon gave warmth, the sun (that is, the fixed star,) coolness.

212. It was even possible to warrant this by certain re-actions. Gazing at Jupiter, as at all brilliant light, was unbearable to her for any length of time. Of all the stars together, she said that they acted upon her in combination like a rather weak magnet, not merely in front, but behind, upon the spine; principally, however, on the head, where she was most highly sensitive to all magnetic influences. I connected a copper plate of about a foot square with a long brass wire, which led to the sensitive, whom I had shut up in darkness on

the staircase. The wire gave out at its extremity, from the copper and from itself, a small flame; but when I let the light of the stars fall on the copper plate, without making this known to the patient, she informed me after a short pause of the rising of a slender flame to the height of more than a span. It rose and sank again as I placed the copper plate, in the starlight, or removed it. When I took a zinc plate instead of the copper plate, I had the same results with the same alternation, only weaker. The plate furnished corresponding effects upon the feeling. The wire carried from it became cooler, when the starlight fell upon it, more when no large planet could shine upon the plate, less when one of these partly neutralized the collective action of the stars.

In these observations there is nothing which should be very surprising after the contents of the preceding treatises; but they are certainly a beautiful voucher on the one hand for confirmation of that which we have already observed in the sun and moon; on the other hand, of the fact that the whole material world, even that external to the earth, acts upon us with just that same force, which displayed itself as existing in all terrestrial matter: finally, that we *stand in connection with the universe by a new, hitherto unsuspected reciprocation;* that consequently the stars, also, are actually not altogether without influence upon our sublunary, perhaps even practical world, and the proceedings of many heads.

213. Thus we arrive at the concluding result of this treatise:—In the same manner as the capacity dwells in the magnet, crystals, organic beings, the sun's rays, heat, electricity, &c., which have been recognised as special sources, to display characters of an unknown force common to them, so *has this force its seat in all the investigated, most dissimilar, and thus* doubtless *also in all even aeriform amorphous matter, the heavenly bodies themselves included, and takes its place, therefore, as a perfectly universal and all-pervading force of Nature.* In the first ten sources, we see it appear *concentrated in isolated points of the material world;* here, however, we recognise it as *an universal adjunct of all matter in variable, unequal distribution.*

214. Whether now this *natural force extending over the universe* is a totally new, or a hitherto hidden modification of a known one, or whether it is a complication of some of the already known, in a still uncomprehended collocation—this, and much else of importance that still remains in question, I leave untouched for the present. I have now arrived at the point, where all the sources from which I have seen it evolved, are combined and included. In the succeeding treatises, I shall compare them one with another, and strive to develope

them in many relations which I have as yet only partially indicated; higher judges will then perhaps undertake to pronounce judgment on the whole.

215. In conclusion, I will further venture to make an effort toward the removal of the difficulties of language connected with subjects of this kind, and with which I have manifestly been struggling all through this work. In the cases where the force, now in question, has been seen to present itself, in isolated manifestations, during the last seventy years, it has had the greatest variety of names applied to it, almost all of which have been derived from certain resemblances or complications with magnetism. It has always been regarded as more or less identical with the latter. But, from what I have unfolded, it is seen that it has no more identity with this, than magnetism has with crystallization, than crystallization with electricity, electricity with affinity, than heat with light, &c. We do, indeed, suspect the final unity of all these dynamics in the ultimate, higher instance; but at present we are far distant from this desired goal of natural science; we cannot even fill up the gap which exists between magnetism and electricity, which appears so small that one imagines that one can reach with the hands from one side to the other. But so long as an empty iron rod, which will not support an iron-filing, displays as much power in regard to the force, of which we are treating, as a powerful steel magnet of equal size, (§ 194;) so long as magnets and crystals are met with acting with equal strength upon the nerves, the former of which will support masses of iron, while the latter will not lift up a filing, (§§ 37, 42, 43, 44,) and no scientific account can be offered of this vast distinction, so long will the two forces remain essentially different, so that we cannot examine them under a common point of view; and therefore, for the present, a peculiar fitting name appears to be necessarily required. Leaving the entymological derivation to be justified at some other opportunity, I will take the liberty to propose the short word *Od* for the force which we are engaged in examining. Every one will admit it to be desirable that an uni-syllabic word beginning with a vowel should be selected for an object which occurs universally in an infinity of complex conditions of the material world, for the sake of convenient conjunction in the manifold compound words. The words magnetism, electricity, &c., are by far too long for convenient use in the language of science. When they are lengthened by additions, as in vital magnetism, animal magnetism, &c., it becomes as burdensome as it is false, for these things do not belong exclusively or even principally to life, still less are they identical with magnetism. To that which supports iron, and constitutes the compass, let us leave the old name,

with the original conception of a supporter of iron, which belongs to it. If, then, the term Od shall be found acceptable in general use, for the force which does not support iron, and for which we require and seek a name, the nomenclature for all its various kinds of derivation may be easily formed by composition: avoiding all circumlocutions, instead of saying, "the Od derived from crystallization," we may name this product *crystallod*, that from animal life *biod*, that from heat *thermod*, that from electricity briefly as *elod*, from light *photod*, and so on, *magnetod*, *chymod*, *heliod*, *artemod*, *tribod*, and for the material world generally, *pantod*, &c. I am quite aware that objections may be urged, here and there, against the grammatical accuracy; that it might, perhaps, be more correct to say *thermood*, &c. Nevertheless, when it is intended that new words should make their way into practical use, custom and convenience require that the schools should sacrifice some of the strictness of grammatical accuracy to euphony. It is possible, indeed very probable, that we shall one day succeed in bringing the incommensurable fractions which we now comprehend under the names of magnetism, electricity, crystallization, light, heat affinity, &c., under a common denominator; but the numerators will always remain unlike, and therefore it will always be necessary to connect and retain groups of phenomena, which we call magnetism, electricity, &c.; and thus, whatever may be the ultimate scientific fate of this which I now think it necessary to comprise under a new expression, we shall scarcely at any time be able to dispense with such a word as Od, or some synonymous one in its place.

RETROSPECT.

a. Not only magnets, crystals, hands, chemism, &c., but all solid and fluid matters without exception, produce sensations of coolness and tepid heat equivalent to pleasure and inconvenience.

b. The effective force, therefore, does not appertain to particular forms or especial qualities of matter, but it dwells in matter in and by itself.

c. This force not only manifests itself in contact, but also at distances,—as from the sun, moon, and stars; so, also, from all matter.

d. Substances arrange themselves in the order of the electrochemical series.

e. In this, the electro-positive substances stand on one side with potassium at their head, the electro-negative on the other with oxygen in the furthest limit: all electro-positive metals occur among those giving warmth, and producing unpleasant sensations; all metalloids on the cooling, agreeable side.

f. We find here conductibility, transferability, and luminosity, with glowing vapor and flames.

g. Finally, this force is one that extends over the entire universe.

h. Nomenclature. The word Od, odic, with inflexions and compositions.

SEVENTH TREATISE.

DUALISM IN THE PHENOMENA.

216. The polar opposition in magnets, the dualism in every crystalline form, the symmetrical and sexual opposition in all living organization, made me conceive, even at the beginning of the present researches, that something of the kind might prevail here. The first and most evident character of this was afforded by the constantly recurring sensations of heat and cold, of pleasure and discomfort, which healthy and sick sensitive persons imagined they felt from all material objects. I did not, indeed, find all these persons agreeing as to those sensations from the same substratum, but as to the quality of any, when once they had determined its place among the warm or cold materials, all the sensitive almost always persisted in their first opinion. There must, therefore, necessarily exist here objective causes in respect to the substance, and subjective causes referable to the form of disease, which determined the, on one hand, constant, on the other, inconstant statements. An attempt gradually to advance along the trace of *warm and cold*, in order to arrive, by further investigation, at a certain scientific truth, was consequently surrounded by difficulties of manifold and peculiar kinds. They were only to be overcome by patience.

217. The first question was: What does the expression warm signify in the mouth of the sensitive? What the term cold? All the objects which they thus designate are, in every case, of equal thermometrical temperature; these words, therefore, cannot mark anything real, but must indicate an apparent temperature, and the expression is therefore to be taken in a figurative sense; it signifies an *effect upon the sense of feeling, which resembles that of heat and of cold*, depending upon some unknown cause.

218. Miss Sturmann found both a flask of oxygen gas and a piece of sulphur hot; Miss Reichel found them both cold; and Miss Maix found both hot while lying in her hand, but diffusing a cold air around: in the collective idea of difference of temperature in relation to the temperature of the air, at each time they all agreed; but as to the determination of the degree I received very different ac-

counts; from three observers three different statements, and all three kept constantly to the same statements at all times and in every repetition.

219. From this it clearly followed, that not only was the objective cause residing in the matter present in unequal degrees in different substances, but that unequal irritabilities existed in different diseases. These latter, again, could either establish merely quantative distinctions, so that a substance reacted more strongly or more weakly upon a patient, which would, however, over-excite another; or qualitative distinctions might exist where, in one disease, a particular substance had always a warm reaction, in another always cold.

220. To get nearer to the natural laws lying concealed here, the question required to be stated more simply; it would not do to begin with substances of different kinds, it must be attempted with those identical. I therefore returned to my rock crystal and selenite, in which I might hope to bring to observation, in one and the same example, the different temperatures which appeared to the sensitive to run through all nature, and from this point to carry out the comparisons. With Miss Nowotny, therefore, I took a selenite four inches long with a natural point, and drew it over the inside of her hand from the wrist to the tip of the middle finger, near the skin, but without touching it, while she was in the north-south position. She felt a cool wind pass over, as if one had blown on her hand through a straw, as has already been mentioned in § 38. I then reversed the crystal, and took the same course over the hand with the opposite point of the crystal; she now experienced no cold, but a tepid warmth, which was, besides, disagreeable. A rock crystal, rather longer, carried down over the hand in the same way with both ends, gave the same results. Miss Sturmann felt the downward pass over the hand of one pole of a tourmaline, warm; of the other pole, cold. Iceland double spar acted upon her exactly in the same way.

221. Miss Atzmannsdorfer expressed herself in the same way: the above selenite, passed down over her right hand, gave coolness to her with the same end that had given it to Miss Nowotny. When I passed the same point down over her left hand, she felt it still cooler. Reversing the crystal, the pass down the right hand was warm, down the left unpleasantly tepid. I made the same experiment with Miss Reichel. I passed the same selenite over her hands. The same end which had caused coolness to the above different sensitive persons also produced coolness in the downward pass over her right hand; in like manner over the left also cool, but more strongly and more agreeably. When I reversed the crystal, and operated in the same

way with the other end, she found the pass down over the right hand scarcely cool, on the left hand warm. She said, when passing downward, it seemed as if something was taken from her; when upwards, as if something was given. Miss Maix expressed herself just in the same manner in similar experiments.*

222. Similar accounts have been given at §§ 33, 34, 35, in regard to M. Schuh and Professor Endlicher. In the meantime many other persons who have experienced the same sensations have given me permission to cite their testimony: M. Theodore Kotschy, Dr. Venzl, M. Voigtländer the optician, Mr. Incledon, M. Studer; the joiner Tischler must also be named among the healthy sensitive. M. Kotschy, as well as Mr. Incledon, could only bear a few repetitions of the pass of the cold end of the large rock crystal from the head down over the body, as they then felt sensibly affected in the stomach, and I was compelled to desist.

223. Generally, therefore, did all the experiments and witnesses agree, *that one pole of the crystals gave a cold, the other a warm pass.* I say expressly, generally, since here and there single persons occur who cannot settle properly about cold and heat, fancying the same passes to feel sometimes cold, sometimes warm, varying between the two feelings in different dispositions, or only becoming certainly clear and consistent as to the quality of the sensation after repeated passes. But there are in all cases healthy or merely slightly indisposed persons; the properly highly sensitive are but seldom in doubt. Novices in the experiments are, in particular, less clear at first. The special cases, however, in which the decision between cold and warmth was variable in them, I shall discuss hereafter, and trace them back to definite clear cases.

234. When a dualism in the crystallized bodies had been substantiated both by these facts and through much of that which was detailed in the second of these treatises, a dualism which follows in an unmistakeable parallelism with that of crystallization itself, the questions arose, what is the nature of this dualism? Does it consist of a duplicity? Or does it correspond to a real presence and absence? Or is it like a positive and negative opposition? I acknowledge that I can as little give a definite answer to these, as we can find a certain intelligence of cold and heat, of + E and — E, of +

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* This experiment I have made many times, and the striking corroboration afforded by my own experience to this fact is very agreeable; for not only does it afford us a general rule as to the difference between the effects from the two ends of the crystals, but it tends to establish the difference of the agencies of either end of the crystal when passed directly or inversely in relation to the brain.

M and — M, &c. I was obliged to be content, for the present state of matters, to make certain of a parallelism which I might perhaps hope to discover between Od and crystallization, magnetism and electricity.

225. We know, from what has gone before, that Od has much agreement with magnetism, leaving out of consideration the capacity of the latter to attract iron, to take a direction from the terrestrial magnetism, &c.; in particular, that it affects the sensitive exactly in the same way. When I passed a magnetic needle down over the hands of different highly sensitive persons, they received exactly the same sensations as from a crystal of selenite, calcareous spar, topaz, &c. As a rule, the northward pole, that is, the negative end of the needle, declared itself cool; the southward pole, the opposite positive end of it, warm. When a perfect agreement of certain poles of crystals with certain others of the magnet was thus brought to evidence, a right was acquired to conclude a similarity of cause, and to apply a similar nomenclature to those poles of crystals which exercised effects wholly homologous to determinate poles of the magnet, and were gifted with corresponding fundamental qualities; so that when + M agreed with Od, we could apply the term + Od, and in reverse in the same way — Od.*

226. In order to work this out, I first investigated, more minutely, the relations of the sensitive to the poles of the magnet. I placed a small magnetic rod in the hands of Miss Maix; it was about four times as long as the breadth of her hand. I first made her place both fists close together in the middle of the rod, so that the latter passed through both, the northward pole being turned toward the left side. She experienced a moderate amount of disturbance from this. I then made her advance her two fists along the rod, the left toward the left, till it enclosed the northward pole; the right toward the right till it enclosed the southward pole, briefly, in such a manner that she had one pole in each fist. The effect of this alteration was very perceptible; she now experienced a very active disturbance through both arms, the breast, and head. When she removed one hand from the rod, the disturbance ceased suddenly; it returned and vanished alternately, as she alternately grasped and let go one pole, retaining the other in the other hand. The same occurred when she repeated the operation with the other pole. Therefore, there was a condition like a current, a kind of circuit, as was observed before on the occasion of the contact with both my hands, of which I have al-

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* I have repeated these experiments on many impressionable subjects, and can afford a strong corroboration of the facts. In some cases sleep and vigilance result according to the pole offered to the patient.

ready given an account in the third of these treatises, § 86. For the control of this, I repeated it with a large horse-shoe magnet, placing one of her hands upon each pole, the left upon the northward. She immediately became pained and oppressed in the breast, by the circuit which she felt through this from the arms; the head was involved and soon rendered giddy, and the patient was again reminded of the "ring-game" which she had spoken of in the former case, &c. The moment I let her take one hand away from the magnet, she felt at once the interruption of the circuit, and again breathed freely. Every repetition afforded a similar result. In both experiments, especially the latter, stronger one, it was requisite that the northward pole should lie in the left hand, the southward in the right, for the sensations to be in any degree supportable: when I reversed the poles the patient could not bear it; she again experienced the strange conflict within her, already described, and evinced so great internal torment, that I was obliged to give up the experiment immediately. If I venture to assume the existence of a circuit here, like that of the galvanic current, I am obliged to conclude that it here flowed from the positive southward pole, through the right arm and upper part of the body toward the left side, and then through the left arm and hand down to the negative northward pole of the magnet. Then, *the left hand of the patient corresponded to the southward pole, and her right hand to the northward pole of the magnetic needle: in other words, her left would be positive, her right negative, in relation to magnetism in the old unaltered sense of the terms,* and the quality of the left hand would have to be indicated by + Od (here = + biod), and that of the right by — Od (here = — biod).

227. It will be remembered from § 86, that when I had placed my right hand in her left, and my left in her right, a similar circuit was felt by the patient, which she was able to sustain; but that when I crossed my hands, so that the hands of the same name came together, namely, my right in her right, and her left in my left, the often mentioned so-called struggle arose within her, which she could not sustain, since it was insufferably painful to her. From this it follows, that my male hands corresponded perfectly, in qualitative magnetic respects, with the female hands of Miss Maix, that my right took the place of the negative, northward pole, and my left of the positive, southward pole, and therefore they possessed magnetism, with positive and negative properties, in just the same order as those of the patient; consequently, that *men and women are organized exactly with the same polarity in those points.**

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* Dr. Elliotson had a very remarkable case (Adlard) illustrative of this conclusion. When the patient, a male, was in mesmeric sleep, the two sides of the

228. After I had cleared this up, I placed the magnetic rod in the left hand of Miss Maix, in such a manner that it extended from the tip of the middle finger upwards to beyond the hand, and on to a part of the arm. The northward pole lay above upon the arm, the southward below on the tips of the fingers: thus all remained in its natural arrangement. When I reversed the rod, discomfort commenced; the so-called struggle began from the wrist to the fingers. I now pushed the magnetic rod up her sleeve, so that it lay upon her fore-arm. When I kept the arrangement such that the northward pole lay above at the elbow and the southward below at the wrist, the patient found its position in accordance with the natural conditions; when I reversed the rod, the disagreeable contest at once became felt again.

I repeat here the observation which I have already made in an earlier place, and which must not be left out of consideration in the critical examination of these phenomena, that the patient lay in the magnetic meridian; the head to the north, the feet to the south, and the face looking southward.

229. If, now, as all up to this point has testified, the same force and influence upon the living organism occurs in crystals as in the magnet, a simple crystal brought into the same circumstances as the magnetic rod ought to produce the same results. I placed a crystal of selenite between the two hands of the patient. It soon appeared, however, that it was anything rather than indifferent how it lay between the tips of the fingers of the two opposite hands. First, she soon felt out that the two most distant points of the rhombohedron were indeed part of an internal force of the crystal, but not the strongest, for there were two others in the direction of the short diagonal, which were much stronger, and coincided with the polar main axes. Neither were the poles of their axes alike, for she found one distinctly warmer, the other cooler, just as the patients had always found. When she now held the crystals between her two middle fingers, so that the cool pole lay on the left middle finger and the warm on the right, the condition of matters was in certain respects accordant; but when I reversed the crystal the often-mentioned discomfort appeared. The cool pole of the crystal, therefore, corresponded to the northward pole of the magnet; the warm to the southward. When I

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body were so different one to the other that he could not suffer his legs or his arms to be crossed. He could not allow his right hand fingers to touch his left cheek, or his left hand fingers to touch his right cheek. In either case he started as if he were burned. He could not endure the Doctor's right hand to touch his left side, or the contrary.—See *Zoist*, vol. iii., page 58; where some other particulars of this young man's case will be found.

placed the crystal in the patient's left hand, short as it was, for the main axis only measured four inches, it was by no means indifferent to her in what direction the axis lay. If the cool pole was directed upward toward the wrist, the warmer toward the fingers, the patient found it pleasant, but if I reversed the direction of the poles, the disturbance of the internal conflict commenced, even though over a small extent. Similar experiments with granite, staurolite, and heavy spar, furnished exactly the same results.

230. I should scarcely have ventured to lay so much weight upon these observations if I had made them upon Miss Maix alone. It might have been a peculiar, perhaps variable, result of disease. But I always obtained exactly the same effect in repetitions of it in very different conditions of disease. When I extended to Miss Nowotny, already far advanced in convalescence, one of my hands, she felt each singly, in exactly the same way as Miss Maix; and when I gave her both hands, she felt herself subjected, in like manner, to the sensation of a circuit, which she could not long sustain. Miss Atzmannsdorfer found my right hand warmish in her left, my left hot in her left; when I gave her both hands, she at once felt the circuit, which affected her whole body, and rendered her head giddy. But when I extended my crossed hands to her, I was not very successful, for the effect was so violent, that she began to lose consciousness, even in a few seconds, and I was obliged to pause. With Miss Reichel my right hand was never disagreeable in her left, but my right was painfully unpleasant in her right. She felt the two oppositely corresponding hands through the whole arms, and soon in the head, but not nearly so strongly and insupportably disagreeable as when I grasped her crossed hands. All this is in perfect agreement with what I have circumstantially detailed of Miss Maix.

231. Thus the law is evolved, that determinate poles of crystals and of living organized structures correspond to the poles of the magnet in relation to Od, that *crystals have in this sense a clearly displayed north and south pole; that the cooler always corresponds to the north pole of the magnet, the warmer to its south pole, and finally that, of the human hands, the right corresponds in kind to the northward pole, the left to the southward, both in the male and female sex.* Therefore + Od (here + crystallod, or + biod) presents itself equivalent to + M, and − M parallel to − Od, &c.

232. For the further confirmation of the facts here unfolded, I will include in my report some other similar conditions, which have presented themselves in healthy persons, in particular in M. Carl Schuh, the private physicist. A man of healthy, powerful aspect, thirty years of age, and of vividly sensitive temperament, he exhibit-

ed far more excitability by Od, than many other persons, so that he thus constituted a certain medium between unsensitive healthy persons and excitable nervous patients. He had hardly ever been ill, but when he over-applied himself to his labors, he sometimes suffered for some hours from headache. He vividly experienced the influence of all crystals; large magnets affected him distinctly, even at the distance of a yard. When I placed my right hand in his left, he felt a disagreeable effect, in a few minutes, in his head; and when I took his right hand with my left, the disorder increased rapidly; it rose in a few minutes from the temples towards the brows, and in half a minute produced a throbbing headache, which soon became almost insupportable, and remained for almost eight minutes after I had set his hands free, disappearing gradually and slowly; when I crossed my hands with him, as I had done with the highly sensitive, he found it exceedingly unpleasant. Starting from the later observations, namely, that the right and the left stand, in the relation to one another, of negative and positive, I proposed to him to use his own right and left hands instead of mine, and to place his hands one within the other, without the interposition of mine. To the no small astonishment of himself and the rest of the company, he found that his headache came on immediately and just as strongly as when I had given him my two hands; that it remitted and gradually disappeared when he separated his hands, but, every time, returned directly he folded them together again. His negative right on his positive left formed a kind of "element," if I may borrow this expression from galvanism; the arc was completed by the arms and body, and the polarization, or, if the word may be admitted for once *in subsidium*, the circuit commenced, and then acted upon the brain. Several months later, when we again came to speak on the subject, he told me that at no time does he dare to leave the hands together: since he has known the effects, the commencement of the disturbance at once reminds him to separate his hands whenever he accidentally brings them together. Other healthy sensitive persons exhibited wholly similar results. M. Kotschy at once felt affected by my hands, and when I reached him both, he described the effect as a kind of circuit, which flowed from and to me, through the arms and chest. When I gave the two hands crossed, he represented his sensations as annoying painful shocks in the arms and head, almost in the same words as Miss Maix. But M. Kotschy never suffered from headache. Mr. Incledon received a quite unbearable headache from my two hands; especially, however, when they were given to him crossed.

233. We are now in a position to cast a retrospective glance over

the most striking phenomena in all the sensitive; namely, that when lying on the back in bed, or in a similar position on a seat, they were of all directions least able to bear the west-easterly position. This is the position with the head to the west and the feet to the east, the face turned towards the east. In this position, the whole right side is turned towards the south, while the entire left is directed to the north; or in other words, the positive side of their bodies is turned towards the positive pole of the earth, and their negative to the negative. Equivalent, therefore hostile poles, are turned directly towards each other, and since these mutually repel each other, it becomes to some extent comprehensible why such a position must become so exceedingly injurious to the patients so highly sensitive in these points. In July, when Miss Nowotny endeavored to go out again, she was utterly unable, even out of doors, to bear a walk from the west towards the east. It would be impossible to find more perfect confirmation of my preceding observations; and M. Schuh is no bedridden and obscure patient, but an active man known and seen by half Vienna and half Berlin.

234. I undertook a thorough control of the law obtained with Miss Reichel. It is known from the preceding treatise that I possessed series of simple substances and preparations, prepared by Miss Nowotny and Miss Maix, arranged by them according to the degree of discomfort they experienced from them. But in their graduated series, although they ran by regular degrees from the electro-chemically strongest substances to the weakest, no regard at all was had to their negative or positive relation in the electro-chemical series; only the quantity of their effect upon the sensitive had been taken note of, and not their quality. If, then, as had every appearance, the distinction between cold and warmth, in the feelings of the sensitive, be founded upon a distinction between negative and positive, in the same way as between the poles of magnets and of crystals, the above-mingled series should be capable of being divided into two halves, according to their difference of cold and warmth by those who felt this, one of which halves should comprise the negative, the other the positive substances. In this experiment I used the series of substances Miss Maix had formed as a basis, and made Miss Reichel bring this into two groups, according to cold and heat. I here give the result. The series proceeds from the greatest strength down to the least. The numbers denote the order in which they were originally placed in Miss Maix's series, before it had been divided into two by Miss Reichel.

WARM.

2. Potassium.
3. Caffeine.
5. Purple of Cassius.
7. Brucia.
15. Chromic acid.
19. Picamarate of lime.
21. Bromide of silver.
22. Iodide of silver.
23. Iodide of bismuth.
26. Picamar.
27 Atropine.
28. Acroleine.
31. Rhodium.
32. Narcotine
35. Strychnine.
37. Sesqui-oxide of lead.
38. Alloxan.
40. Picrotoxine.
41. Ultramarine.
43. Mesite.
46. Citronyle.
47. Draconine.
48. Bismuth.
52. Creasote.
53. Potassa.
57. Lithium.
58. Cantharadine.
61. Cetine.
64. Æsculine.
66. Baryta.
70. Melamine.
74. Grey pig iron.
75. Murexide.
76. Protoxide of manganese.
78. Hydrate of oil of turpentine.
79. Cholesterine.
80. Asparagine.
82. Hyoscyamine.
85. Alloxantine.
88. Caryophylline.
89. Allantaine.
90. Sulphuret of ammonia.
91. Lime.
94. Gold.
97. Zinc.
98. Stearine.
99. Chromium.
101. Osmium.
104. Palladium.
107. Mercury.
108. Delphinine.

COLD.

1. Oxygen gas.
4. Sulphuric acid.
6. Iodide of gold.
8. Diamond.
9. Chloride of gold.
10. Sulphur.
11. Bromine.
12. Tellurium.
13. Osmic acid.
14. Selenite.
16. Lunar caustic.
17. Orpiment.
18. Chloride of mercury.
20. Oxide of platinum.
24. Iodide of carbon.
25. Iodide of mercury.
29. Iodine.
30. Telluric acid.
33. Cyanide of mercury.
34. Selenium.
36. Paracyanogen.
39. Prussic acid.
42. Sulphuret of potassium.
44. Arsenic.
45. Oxide of mercury.
49. Iodide of lead.
50. Chloride of cyanogen.
51. Chloride of lime.
54. Oxide of copper.
55. Cyanide of potassium.
56. Sulphuret of calcium.
59. Sulphate of morphia.
60. Bromide of potassium.
62. Cyanic acid.
63. Antimonic acid.
65. Sulphuret of cyanogen.
67. Hydrate of baryta.
68. Parabanic acid.
69. Borax.
71. Acetate of morphia.
72. Hydrochlorate of citronyle.
73. Phosphuret of nitrogen.
77. Oxide of cobalt.
81. Titanic acid.
83. Uric acid.
84. Neutral phosphate of lime.
86. Chloride of carbon.
87. Carbazotic acid.
92. Phosphorus.
93. Bichromate of potass.
95. Oxide of nickel.

WARM.

109. Daturine.
110. Lead.
113. Oleic acid.
116. Cadmium.
117. Sodium.
118. Antimony.
121. Red lead.
124. Morphia.
125. Benzamide.
126. Veratria.
127. Indigo blue.
129. Titanium.
132. Naphthaline.
133. Coal wax.
137. Nickel.
138. Copper.
139. Santonine.
140. Iridium.
141. Tin.
142. Cobalt.
148. Amygdaline.
149. Mellone.
150. Quinine.
151. Piperine.
156. Benzoyle.
157. Urea.
158. Platinum.
159. Silver.
163. Eupion.
167. Bar-iron.
171. Paraffine.

COLD.

96. Alcohol.
100. Chloride of chromium.
102. Albumen.
103. Ammonio chloride of platinum.
105. Protoxide of chromium.
106. Black lead.
111. Oxide of silver.
112. Common salt.
114. Molybdic acid.
115. Iodide of potassium.
119. Sulphate of iron.
120. Nitric acid.
122. Oxide of manganese.
123. Sebacic acid.
128. Stearic acid.
130. Massicot.
131. Oxamide.
134. Cinchonine.
135. Melan.
136. Hippuric acid.
143. Fumaric acid.
144. Malic acid.
145. Benzoic acid.
146. Lactic acid.
147. Cinnamonic aid.
152. Peroxide of lead.
153. Gallic acid.
154. Tannic acid.
155. Succinic acid.
160. Spring water.
161. Mannite.
162. Charcoal.
164. Starch.
165. Gum.
166. Sugar.
168. Vinegar.
169. Sugar of milk.
170. Citric acid.
172. Distilled water.

235. When this arrangement is examined, it is seen that almost all metals, potassium at the head, with the isolated exceptions of tellurium and arsenic, are on the side of the warm bodies,—therefore, on the especially negative: we find, further, under this head, almost all organic substances, and organic bases; the compounds of carbon, rich in hydrogen, and barely a couple of acids, chromic and oleic. On the other hand, we observe in the opposite, cold side, all bodies like sulphur, bromine, iodine, selenium, all compounds of chlorine, the oxides of the metals, all compound of cyanogen, and almost the

whole of the acids. So far as we can judge of the substances, we perceive on the warm side scarcely anything but electro-positive—on the cold side, scarcely anything but electro-negative. It is certainly surprising, and in the highest degree worthy of notice, that a human being—a girl perfectly ignorant of such things—is capable of classifying with certainty and accuracy, according to one of their innermost, profoundest, and most obscure peculiarities—their electro-chemical character, all the substances of this world, without seeing them, and by mere dull sensation.

236. As we have been compelled to infer of the magnet, crystals, and human hands, *all warmth-giving substances are positive*, so are we now obliged to conclude that *all positive bodies give out heat.* This holds good in the reversed formula of the negative, and thus we arrive, in a different way from that already known, at the electro-chemical series of bodies, which, from this point of view, we may call the Od-chemical series.

237. As to the manner and circumstances by which I obtained this result, I may add, that I gave the observer all the bodies which consisted of solid substance, into her bare left hand; the pulverulent on a fine, very thin tissue paper, which did not require to be taken into account; and the fluid in the bottles in which I usually kept them. I did not neglect to control this operation repeatedly, and most minutely, by making the same trials over again, in modified ways. At one time I placed all the bodies at one end of a long and wide glass tube, while Miss Reichel grasped the other in her whole hand. When I inserted one body after another into the tube, the feeling of warmth and cold changed in a moment. Another time, I selected a glass rod of such condition that it was not felt either warm or cold. With this I let her touch the substance, inserting it into the powders and fluids, and placing it against the side of the solids. With this kind of feeler she very accurately distinguished the warm or cold condition of bodies every time; and I can, from experience, especially recommend this mode of testing, as readily provided for, everywhere applicable, and very clear to the observer. By means of two such rods of equal thickness, very accurate comparisons between two different bodies could be made. The examination of bodies, by placing them, together with the bottles in which they are contained, in the hands of the patients, is only possible with substances of great strength; as with sulphuric acid, potass, caffeine, &c. In the weaker, it is inadmissible, because the glass itself has very different properties, feeling, according to its chemical condition of admixture, sometimes warm, sometimes cold, and sometimes indifferent, and thus readily rendering the result incorrect. This frequently goes so far,

that weak substances, which by themselves feel cool, are thereby made to feel warm, and *vice versa;* and then errors will be produced. Salts and other preparations, which occur in a crystalline condition, must be powdered before testing, even if only coarsely. For, since the crystals are polar, no pure result of quantity can be obtained from a group, as isolated crystals affect the result by their poles, and render it complex. I hesitated a long time, for instance, with saltpetre and bichromate of potass, between warm and cold, until I powdered them, when a constant coolness presented itself. And when a substance is powdered, it must not be examined immediately, but after some hours. For, the mortar and pestle in which it has been powdered influence it for a long time, through transference: in like manner, the rubbing in the trituration alters the natural odic value, since it brings in accumulation from friction, perhaps also from electricity, that may be thereby set in motion. Finally, the substances to be examined must not be allowed to remain previously for any time near other, especially much stronger or much weaker ones, because they will, in that case, become altered by transference; moreover, they must not have stood in the sunshine, nor in the moon's rays; they must not have remained long in the hand; when several are to be compared together they must be tolerably equal in temperature, &c. All these things would interfere with the purity of the result, as is abundantly evident from the preceding treatise.

238. I need scarcely observe that the series which I have above given is not to serve as the normal, but only as an example, and as a help to the argument. For to have been laid down as the type, it would have required the previous most accurate investigation of the chemical purity of the substances, a labor for which neither time nor circumstances have yet afforded sufficient opportunity. I merely intended to seek out and lay down the law; its accurate application will belong to another time. Countless other preliminary investigations are also requisite here, the infinity of which I fully feel and recognise; in the first place of all, these testings of positive and negative character of bodies, which I was here first able to carry through with Miss Reichel, must be undertaken with several other sensitive persons in different conditions; thereby must be found the key to the distinction of their sensations, as also the results of more exalted or lower excitability, in comparison with Miss Reichel, who, since her sensations coincided so accurately with the general electric condition of bodies, as it has been made out previously in other ways by physics and chemistry, must have been in a remarkable equilibrium,—one might say, of purity of diseased condition.

239. We will now make some applications of the discovered law,

that substances which affect the sensitive as warm or cool, the thus od-positive or od-negative, correspond to the electro-positive and electro-negative. First of all, we found the sun strikingly cool, but the moon strongly warm on the sensitive; the fixed stars ranged themselves with the sun, the planets with the moon. I do not know whether astronomers have yet made out anything positive on this subject; so far as my knowledge goes, nothing has been made known on this point, except what M. Kreil* traced into the qualities of the moon, from the interference with the declination of the magnetic needle. It is then certainly in some degree interesting, that the human feelings should be able to carry us so far as to recognise that the fixed stars take their place all on the electro-negative,—the moon and the planets on the electro-positive side: luminous and illuminated stars are thus opposed in a polar manner to each other. Perhaps we shall one day succeed, if not in deciding, yet in raising a probability, that a comet which only sends us polarized light is actually a reflecting and not an illuminating body. Subjecting this to rigid criticism, it may indeed be objected that the feelings do not necessarily point here to the electro-chemical condition of the heavenly bodies, but only the influence of their emanations; their rays of light, of heat, &c., are perceived in the feelings of the patient. I do not at all oppose this; at the same time, all that we have yet succeeded in discovering about the heavenly bodies is perceived through emanations of each kind, by means of our senses; all that we know of them relates to that alone which arrives to us through their emissions, and thus we are in the same position with the odic emanations, which tell us that the sun is od-negative, and the moon od-positive, as the emanations of light teach us that the sun is warm, the moon almost without heat, &c.

240. From § 147, in the examination of the chemical activity, we already know that all fire affects the feelings of the sensitive with cold. This is so far worthy of regard, that we know from the researches of Pouillet (Anal. de Phys. et de Chim., tom. xxxv., p. 402,) that the exterior of flames, which depend upon oxygen combinations, possesses much free positive electricity. This cold is not only diffused from the free fire of od-positive or od-negative bodies,—as from potassium, stearine, oil, alcohol, and sulphur, but it may also be detected when the fire is inclosed, whether it be in positive or negative bodies. For when Miss Reichel approached a stove warmed by the fire inclosed in it, she found it indeed warm at the greatest proximity, so long as its real heat acted in a preponderating degree upon

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* Astrom. meteorol. Jahrbuch, 1842.

her, especially with iron stoves; but when she drew back, scarcely a couple of steps, it caused her vivid sensations of coolness; and the stronger the more actively the fire burnt in the stove. When she was chilled in the winter time, and went to warm herself at the heated iron, it now chilled her through and through, and her fingers, which previously were rather stiff, became perfectly so; she was compelled to go away, and endeavor to warm herself by walking up and down the room and rubbing her hands. It was pretty nearly the same thing whether the stove was of earthenware or of iron. In judging this strange effect, it must not be overlooked what a complex phenomenon this is of what is given out by heat, light, chemism, the electricity thereby excited, the substance of the burning materials, and, finally, of the stove itself. The resultant, however, of all these components is, in all the cases hitherto observed, an uncommon degree of cold to a distance of many paces, so that it drove Miss Maix out of the illuminated churches, (§ 131,) and Miss Reichel, when she remained only a short time in the vicinity of a burning wood fire, was in rapid succession first attacked in the head, then rendered giddy, and at last felt so seized with pain in the stomach, that unless she hurried away she fainted. *Fire, therefore, acts od-negatively on the sensitive in all cases.*

241. The question suggests itself here, what apparent temperature may be shown by flames of that kind which the Od itself produces, and which, invisible to healthy persons, are perceived by the sensitive on the polar ends of wires from all the various sources of Od. To solve this I inserted first a glass rod, which itself felt cool, and an iron one, which felt warm, in a number of substances, and let Miss Reichel feel the flames issuing from the extremities at a distance of two inches. I obtained the following series, exactly similar, from the glass and iron rods:

COLD OD-FLAMES.	WARM OD-FLAMES.
Bichromate of potass.	Gold.
Sugar.	Platinum.
Sugar of milk.	Potass.
Citric acid.	Narcotine.
Oxalic acid.	Minium.
Chloride of lime.	Oxide of lead.
Sulphur.	Cast iron.
Bromine.	Paraffine.
Graphite.	Mercury.
Charcoal.	Tin.
Arsenic.	Cadmium.
Manganese.	Iridium.
Alcohol.	Creosote.
Sulphate of iron.	Iron-filings.

The apparent temperature of the flames agreed accurately, therefore, with the temperature which the substances, on which they depended, had shown, by feeling in immediate contact, by feeling through a long glass-tube, and with a glass rod: *all od-negative substances give cold, all od-positive warm flames. The temperature of the flames, therefore, affords an expression of the odic quality of bodies in general.*

242. This sensitive patient also felt all radiations from electrified bodies cold, especially those positively electrified. The conductor, glasses, and wood-work, all gave heat by themselves; as soon as I electrified them, and only to a strength capable of yielding positive sparks one-fifth of an inch long, and in the moist air of cloudy weather, she felt all these substances perfectly cold at distances of from ten to fifteen paces. This feeling of cold increased rapidly, the faster I turned the plate of the machine, yet was not immediate, but always became first perceptible several seconds later than the electric charge upon the bodies. A fox-skin, by itself warm, gave great cold, when I had beaten an electrophorus cake with it. The same occurred when I let the electricity flow from the conductor into the air through points, instead of electrifying bodies with extended surface.

When, on the other hand, I placed negatively electrified bodies opposite the observer, she found them warm; an electrophorus composed of pure resin, warm by itself, emitted far greater heat after it had been beaten with the fox-skin, and became observably warmer with almost every stroke, up to a certain degree, where it remained stationary.

After these observations the conclusion was warranted, that positively electrified bodies produced cold, negatively electrified, warm sensations. Since this ran counter to the general ascertained theory, the cause of such effect must be derived from the electrical distribution, whereby the air, surrounding the positively electrified bodies in which the observer was placed, was negative by distribution, and consequently as the nearest substance must act negatively upon her sensations,—that is, in opposition to the condition of the electrified body.

243. A great number of experiments were made with the voltaic battery, and this would be the proper place to give an account of the temperature of the odic flames produced by it; but, as the results, on this point, appear too complicated to admit of dismissal with a passing notice, I must reserve the regular description of them for a special treatise.

244. The odic flames which were produced by candle-light, as by sun-light at the end of long wires, all felt cold. Miss Reichel felt the

coolness of the odic-flames issuing from the further end of a long wire, twenty yards long, which was attached to a copper plate, illuminated by eight candles. Here, indeed, both heat and chemical action influenced. Sunlight, directed upon a large plate of iron, and thence turned towards her with the point of a wire, gave a flame of which the coolness reached very far; moonlight, on the contrary, thrown upon the same plate, produced heat in the flame at the point of the wire directed toward the observer; and this, always alike in many repetitions, at very different times.

245. The following experiment, similar to those in §§ 122 and 123, may indicate the condition of the Od produced by heat. With Miss Maix, I had an earthen pot filled with cold water, inserted a wire ten feet long into it, placed the other end in her hand, put a cover over the water, and allowed the patient to become accustomed to this arrangement. I then poured the cold out, and replaced it with boiling water. She at once felt the wire increase in apparent heat,—that is, in odic heat; this acquired a steady maximum in a few seconds. I now threw some pieces of ice into the boiling-hot water: the heat of the wire in the hand immediately began to decrease; it sank continually till it wholly disappeared, and now the temperature was reversed. The disagreeable heat of the wire vanished entirely, and in its place appeared the beginning of a coolness, which continually increased, and soon became very pleasant to the observer, affecting the hand, then by degrees the arm, and so on, the whole person, even to the back. Judging from this, I must assume that the warming produced positive, the cooling negative, movements of Od in the bodies.

246. Rubbing a copper-plate with a piece of wood gave warm ÷ od in the copper wire seven yards long, (§ 125.)

247. The chemical polarization is usually decided by the predominant constituent, which enters into the compound, and in neutral combinations, by specific quality and position of these in the od-chemical series. A number of experiments, relating to this, have already been described in the fifth treatise, from §§ 137, 139—142. I will add a few other instances here. I placed iron-filings in a glass cup, and poured some water on them. A glass rod inserted in this felt rather warm. I poured some vinegar in, and the rod at once gave cold. Vinegar, like almost all vegetable acids, is od-negative. But the rod soon became warm again; the vinegar had been neutralized by the iron, and a great excess of iron-filings remained. I then added citric acid; the same course was followed: in particular, after I had stirred up the mixture a little, the rod became wholly warm again. I next took, *seriatim*, a few other organic acids; all produced the same effect. In another experiment, I used strong solution

of potass, as base, which, being od-positive, made the glass rod warm; sulphuric acid poured into this rendered it cold for a moment, then followed great heat, the alkali remaining in excess. Sulphuric acid added, to neutralization, produced warmth for some moments during the combination, but permanent cold followed; sulphate of potass, like all sulphuric acid salts, is an od-negative body. Effloresced carbonate of soda, placed in water, evinced at once an uncommon degree of cold; the imbibition of water of crystallization, in the place of that lost by efflorescence, was, therefore, an act expressing itself externally as negative. By stirring this, cold was increased for a short time, then it was moderated; carbonate of soda is itself od-negative. Addition of strong diluted sulphuric acid did not act upon the thermometer standing in the fluid, but the glass rod, nevertheless, became very warm during the evolution of carbonic acid; as soon as the effervescence ceased, it again became cold. Sulphate of soda is od-negative, but in the driving out and gasification of the carbonic acid, positive Od was necessarily set free. The observer often said that she felt the sensations like shocks during the decompositions; as the bubbles were formed, she fancied she felt reflex effect in the glass rod. We shall hereafter return to similar phenomena; for in these matters, there is nowhere effect without cause.

All chemical action, therefore, moves in manifold alternations of + and — od, dependent on the position of the substances entering into it, in the odic series; so that the result may always be predicted so soon as the relative value and quantity of these are known.

248. We now come to the examination of living organic structures: in the first place, of plants. I brought to Miss Maix some flower-pots, containing a *Calla Æthiopica*, a *Pelargonium moschatum*, and an *Alöe depressa*. I rolled up one end of a long stout wire into several coils, and gave the other end into the hands of the patient, to allow her to get accustomed to it. I then laid the coils over the plants, so that these were surrounded and involved in them. An unexpected vivid effect displayed itself. The wire immediately became hot in the observer's hand, and this so much that it ran up the whole arm. At the same time, the point of the wire diffused cool wind. The Calla manifested the greatest strength, the Aloë the least; so that it seemed likely that the measure of the strength increases, in equal degrees, with the rapidity of growth of the plant. The quick growing Calla showed itself incomparably more active than the slow Aloë, in spite of its greater mass; while the Pelargonium moschatum always kept the medium. Perhaps the observation is not out of place here, that the Calla belongs to the family of the

Aroideæ, in which it is well known that the strongest evolutions of heat, therefore especial manifestations of intense vital activity, occur.

249. In the end of September, I walked in the fields with Miss Reichel. We noticed all the flowering plants we met with. Entire trees produced a total impression of coolness; single plants in pots, the same, collectively; in particular, however, she found most of them warm on the stem, but the flowers cool: *e. g.*, in *Gentiana ciliata*, *Inula salicina*, *Euphrasia officinalis*, *Odontitis lutea*, *Orobanche cruenta*, *Linum flavum*, *Hordeum distichum*, *Coronilla varia*, *Rosa Bengalensis*, *Pelargonium roseum*, *Iberis*, *Impatiens*, *Alchemilla*, *Campanula*, *Daucus*, &c. Trees were also cold at the upper end, and warm near the ground: *e. g.*, *Pinus picea*, *Abies nigricans*, *Fraxinus excelsior*, *Hippophäe rhamnoides*, *Laurus nobilis*, *Punica granatum*, *Quercus austriaca*, *Betula alba*, *Morus morettiana*, *Salisburiâ biloba*, *Hedera quinquefolia*, *Cassia corymbosa*, *Juglans regia*, &c. Among the Compositæ, she found the ray-flowers of many cool, those of the disk warm,—*e. g.*, *Picris hieracioides*, *Centaurea paniculata*, *Aster sinensis*, *Amellus*, *Dahlia purpurea*, *Senecio elegans*, *Corcopsis bicolor*, *Asterocephalus ochroleucus*, *Scabiosa columbaria* and *atropurpurea*, &c. Some were cool in the stem, the inflorescence warm; as *Plantago lanceolata* and *Salvia verticillata*; she experienced a mixture of cold and heat from families of *Clematis vitalba*, and the capsules of *Papaver somniferum*, where, indeed, she may have felt through the alkaloids and oil of the seed. It results from this, that *different parts of different plants behave differently in relation to Od.*

250. To come closer to the facts, I pulled up a large turnip, and made Miss Reichel examine it. She found the fibrils of the root od-positive, but the tuber od-negative below, and od-positive above; the whole head of the thickened tap-root, especially the neck, where the buds and leaves are produced, very warm; all the leaves warm at the base, slightly warm at the points, but above the middle zone, where they are most widely expanded, very cold. A plant of *Heracleum sphondylium*, as high as a man, had the root warm, the stem, up to immediately below the umbel, warm, round the involucre still warmer, the umbel itself cold. A ripe cucumber and a melon were found cool above, on the remains of the flower, but cold below at the point of attachment to the stem.

251. Hence it followed, that no universal polarization in regard to Od, according in any way with *Caudex ascendens* and *descendens*, somewhat as in crystals, occurs in plants, but that positive and negative conditions alternate at different points: however, *internodes of the same name, and within these, again, parts of the same name, pos-*

sessed like odic disposition: I therefore turned to the investigation of the single organs. First, with Miss Maix, on a young *Aloë depressa.* She found the point of the main axis strongest; on the other hand, in detail, the larger, lower leaves acting more strongly,—that is, diffusing more cold wind than the smaller upper ones; stronger in the axils than at the points; the mid-ribs, with their vascular bundles, stronger than the rest of the parenchymatous mass; lastly, the under surface of the leaves stronger than the upper. The same plant, as well as an *Agave Americana*, when gone through with Miss Reichel, gave the same results: the little stem cooler at the apex than at the base; each leaf stronger at the base and on the under face, than at the point and upper face, and the mid-rib stronger than the borders and parenchyma. The two plants were of about equal size, and bore from ten to twelve leaves. A leaf of *Ulmus campestris*, of *Laurus nobilis*, and of *Punica granatum*, all still upon the tree, were each warmer on the under face than on the upper; and again, warmer at the point of attachment than at the tip. Leaves of *Castanea vesca*, taken from the tree, were compared in three different stages of growths,—when green, when become yellow, and when wintery brown; in all of which conditions they could be obtained in October. The green and yellow acted in general as cooling to the hands of the sensitive,—the green stronger, the yellow weaker, the brown not at all, and behaved, like a sheet of paper, almost indifferently, with a slight indication of tepid warmth.

252. The general results of the experiments on vegetation, so far as they have been thus made in a preliminary manner, would, therefore, allow of our summing them up as follows:—The root-fibres are warm, therefore od-positive; the ends of the leaves, above, are cold, therefore od-negative. The point of the stem loses itself in leaves and leaf-buds; it therefore comes to the negative side. We may say, then, with some grounds, *positive Od predominates in the descending axis; negative Od in the ascending.* This must, however, be accepted with great limitation; for innumerable individual conditions prevailed within these principal states, an infinitely distributed duplicity, in which + and — od alternate a thousand times. The rule peeped forth, however, here, that *where nature is least busy—where the growing activity is slackened, negativity prevails—where propulsion shows itself, positivity.* Thus the vascular bundles in the mid-ribs, the under face of the leaves, and the lower part of the leaves toward the point of attachment, were always found more positive; while the more parenchymatous mass, the upper face of the leaves, and the part toward the tip, were constantly more negative. Physiology teaches us that the leaf does not grow principally at the point, but toward

the point of attachment, that the apex is perfect very soon after it emerges from the bud; while at the stem end—that is, the lower half—the leaf continues to grow for a long time.* The vegetative propulsion, therefore, soon ceases in front, but remains active behind. Here, then, it appears that it is in league with positivity of the imponderables, light, heat, and Od, that creative nature erects her structure; and when she gives up the field to negativity, she carries away life with her in her retreat.

253. We have still to direct our view to the animal kingdom. How immeasurably great the part is which Od here plays, is best shown us by the profound and enigmatical phenomena of somnambulism. The question, however, here, is not of this, but of certain reactions of healthy life upon the sensitive. When I placed a living animal upon a copper plate, connected by a copper wire several yards long, with Miss Maix's hand, though it was very small—for instance, a rose-beetle (*Cetonia aurata*) or a moth (*Bombyx mori*), or any similar creature,—I was astonished to perceive that she instantly recognised this, after a few seconds, by the apparent temperature of the wire, whether she saw it or not. When I placed a larger animal on it, such as a cat, she felt it very vividly. The effect of my own hand, when I placed it upon the plate, spread all over this, as has been already detailed in other places. I have examined the reactions countless times, in hundreds of modifications; they gave the always constant result, that every living creature at once propagates an influence, not only immediately, but even mediately, through various kinds of bodies and long wires, which Miss Maix found as warmth, diffusing at the same time a cool wind, like all the od-diffusing objects of inorganic nature. When I removed the animals, the effect soon ceased, and the wire sank back to its natural peculiar temperature. I made similar experiments with beetles, moths, and cats, on Miss Reichel, which confirmed the preceding in all their results.

254. When I elevated my hands towards Miss Reichel, she felt, even at a distance, warmth flow to her from my left, and coolness from my right hand, as from a distant magnet. Miss Atzmannsdorfer felt the same still more strongly. When I approached Miss Reichel sideways, so that I only turned my right side to her, she felt coolness from me as soon as I came in at the door of the room; when I came forward with my left side, she felt me warm. Not only the hands, but the whole sides of human beings, are, left od-positive, right od-negative. Next to the hands, she found the head especially strongly odic, on the right side negative, on the left positive. The

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* Endlicher and Unger, *Grundz. der Botanik*, § 330.—Schleiden, *Grundz. der wiss. Botanik*, tom. ii. 167.

toes were in the same way greatly strengthened. With regard to front and back, the front of the head was always found cooler, the back of the head warmer down towards the neck. In the arms and hand, both she and Misses Maix and Nowotny found the following arrangement. The tips of the fingers were the strongest; then followed those parts of the hands where the fingers arise; then the tendinous part, at the wrist, *i. e.*, where the hand is attached inside to the fore arm; lastly, the parts of the inside of the upper arm, to which the fore-arm joins. In the fingers themselves, again, there were places of different amounts of sensibility; but in all places where a finger-joint ended downwards, it lay inside. Nature, therefore, evidently proceeds according to the following rule here. From the shoulder to the tips of the fingers, *the point of greatest* irritability, in every joint, *always lies on the inside at the distal end of the joint.* There are, consequently, six places from the shoulder to the fore-arm increasing in sensibility downwards; the lower end of the upper arm, of the fore arm, of the hand, of the joints of the fingers, always lying in the inside: on the outside there is no especially sensitive point.

255. The mouth, with the tongue, is a point of very peculiar strength. It is very cool; that is, od-negative. The sensitive feel all that they touch with the mouth with especial distinctness and strength in reference to its odic value; on the other hand, the mouth of the healthy is a point from which all objects can be charged more strongly, odically, than with the hands. When I held a glass tube, a metallic tube, a silver spoon, a wooden stick, &c., in my mouth, and let the various sensitives feel the other end; they all found them very strongly odified. When I put a glass of water to my mouth, as if I had intended to drink, and then after a short time gave it to the sensitive patient, she took it for magnetized water. When I passed my mouth, closed and without breathing, along the German-silver conductor, without touching it, keeping my mouth only about a minute very close to it, and then allowed Misses Maix, Reichel, Atzmannsdorfer, or Sturmann to grasp it, they found it as perfectly charged as if it had been in contact with a magnet, the sun's rays, the point of a crystal, or my hands.

We here arrive at a not uninteresting explanation of a hitherto obscure matter—*the import of the kiss.* The lips form one of the foci of the biod, and the flames which our poets describe, do actually blaze there. This will be clearly elucidated in the next treatise.

It may be asked, how this can agree with the circumstance that the mouth is od-negative? This, however, does harmonize very well with the fact; for the kiss gives nothing, it desires and strives merely, it sucks in and sips, and while it revels, longing and desire increase.

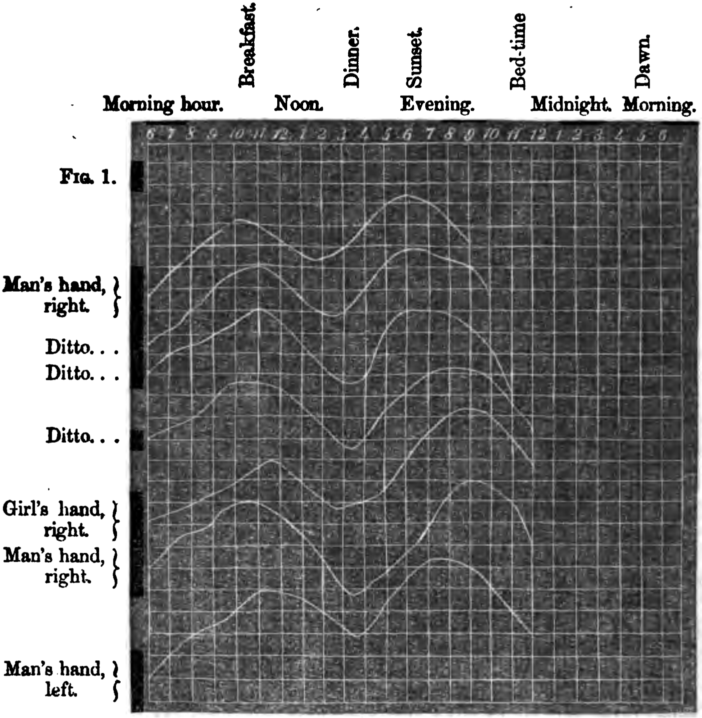
The kiss is therefore not a negation, but a physical and moral negativity.

256. As the Od is unequally distributed *in space* over the human body, so also, I concluded, will it deport itself *in time*. I conjectured from many reasons, that the Od might change its distribution, and displace its relative intensities, in the different bodily and mental conditions which we pass through in the twenty-four hours. If such a guess should prove, from experiment, to be well grounded, I hoped we might gain highly interesting hints, even if not explanation, of sleep, digestion, hunger, growing hot, chilling, the mental changes in their physical effects, and so on as to the questions bordering on physics. And if, in the first instance only, inconsiderable data could be discovered in this way, it would certainly indicate to us a new and promising direction for the investigation of things which are, in all respects, so difficult to throw light upon. With this view, I commenced by letting Miss Reichel make hourly observations on myself, and representing these by graphic lines, in which the times were expressed by the abscisses, and the strength of the Od by the ordinates. I completed the investigations on myself, on my daughter H., and on Miss Reichel herself. A period occurred to the last, in which she remained perfectly sleepless for three weeks, and I availed myself of this time for carrying on the testings, through the night, without interruption. They were arranged in this way: my right hand was grasped by the sensitive every hour, and tested for its strength at that time, measured, and then the point marked upon the table, which proportionately corresponded to the condition of force found. This was continued for twelve, eighteen, to twenty-six hours, in various experiments. My usual habit of life during this was, to wake at from six to seven in the morning, to read in bed till nine–ten, rise, and breakfast on cold weak tea at eleven–twelve, dine at three, P. M., to eat a very little confectionary at ten, P. M., and go to bed between eleven and twelve. I drank neither wine nor beer, toast and water, coffee, nor tea, and did not smoke. I took no exercise beyond a moderate walk, which did not extend further than through the park of the castle; and I passed my time, chiefly, quietly at the reading-desk. In other respects, I was in good health, tranquil frame of mind, and at the age of fifty-six. So much for the circumstances which might have had influence on the experiments. In all cases, I avoided touching with my hand every metallic object, even the lock of the door, which I let others open for me, for a quarter of an hour before the trial of the feeling; after meals, when I had used silver instruments, I always let some time elapse before I gave my hand to

be examined. I also avoided allowing the sun's rays to fall upon me, or going near the fire.

257. Since the standard which could be taken depended merely upon feeling, that is upon the appreciation of a sensation, which could not be controlled by any scale, it can only lay claim to a moderate amount of accuracy. To approach as nearly to the truth, as was possible, under such circumstances, I repeated the same experiments five or six times; those, namely, in which I let my hand be felt, and marked down the result, hourly, from the morning till late at night. This operation is illustrated in fig. 1, and the various results collocated. The agreement which is found between the various series of observations is almost astonishing, and prove that the sense of feeling of the observer, as I have already frequently noticed, possessed a very high degree of clearness.

FIG. 1.



As soon as I attained conviction from this, that observations of conformable conditions could really be obtained in this way, I extended the operation in various directions. I continued them through the night, had them made by females, among others by the observer on herself, &c. I then caused the particular organs of one and the same person to be investigated, and finally, the similar organs of the same persons to be compared with each other.

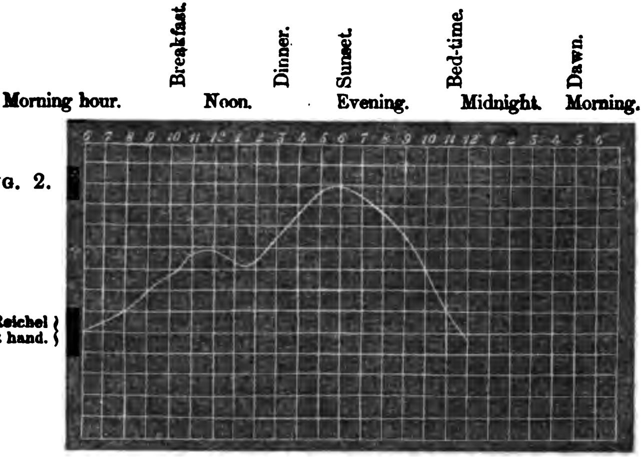
258. We will bring to light the particulars of this. In the first figure are a number of observations upon my right hand, marked by the right hand of Miss Reichel. My right is, of course, od-negative, and continued so for the whole time, since this quality never does alter. But the quantity of it does change, and is subject to a continual rising and falling. I call this the magnitude of the force. It is shown in the drawing, that from six, A. M. forward, at which time the observation mostly began, a growing increase of the force occurred till the hours of ten or twelve. Then commenced a decline, going on till three, P.M. From here started a new ascent, and it became greater until seven to nine, P. M.; then followed a continual decrease until late in the night.

This plate, with its often-repeated observations, proves, that from the time of awaking, although I remained for hours reading in bed, the Od increased in strength in my right hand, growing greater continually after breakfast until toward noon. The rising day, therefore, strengthened the hand. The decline which now appeared, endured exactly till dinner-time, and it hence became evident, that it was the awakening of hunger which brought on the decrease of strength. For scarcely had this been appeased by the dinner, when, with the first spoonful of warm soup, the decline ceased, and the force immediately began to rise, and so on to its maximum, which was attained in the evening at the time of the departure of daylight. Similar experiments with Miss Maix and M. Schuh yielded similar results; both found my hands to influence them more powerfully after dinner than before.

There will be observed on the diagram a slight tendency to decline about nine or ten, A. M. This relates clearly to the breakfast, the desire for which then arises; this case is an appendix to the greater decline before dinner, and serves to corroborate it.

259. In order to make certain of the correctness of the view which I had formed on these points, I caused the experiments to be performed by a person who took meals at different times of the day. Miss Reichel herself dined at my house at one o'clock instead of three. She could observe her own right hand very well with her left, and so undertook this task. A wholly different line was now formed. (Fig. 2.)

FIG. 2.



The same increase of the force appeared generally from morning to noon; its decline, however, which also commenced now, did not endùre till three o'clock, but extended only till one, the hour of her dinner-time, and then ceased at once, to make way for a new ascent of the odic force, which then continued to increase for exactly the same time, and reached its culmination, when the day began to disappear. A little decline was also observable with her at the period before breakfast, which gave place to an increase directly she had taken the meal.

260. From these comparative experiments it follows, therefore, that *hunger diminishes the strength of the Od in the right hand; taking food increases it.* We here clearly come upon the effects of chemism, as they have been elucidated in the fifth of these treatises. The food received becomes the prey of chemical force; digestion, that is, decomposition, begins, and odic action is produced; chymod becomes free, if we like so to express it. It makes no difference whatever, how much or how little share may be attributed or denied to vitality, in these decompositions,—decompositions they remain, and from them arise manifestations of Od, which diffuse themselves over the organism, and strengthen its members.

261. The question of the day being answered, that of the night remains. What is our odic disposition during the time when the luminary of the day, with its vast source of Od, is wanting, and the powerful influence of sleep comes over us? To investigate this, the sick observer must keep awake, and the healthy subject sleep, and

the examination must be continued hour by hour; so that the affair was clearly not without its difficulties. However, I succeeded in persuading Miss Reichel, by explaining to her the scientific value of such an investigation, and the undoubted merit attaching to her for it, to come, since she did not sleep, hour by hour through the night to my bedside, to examine the condition of my hand, and note the result. There was no other means, since, in order to obtain a true result, it was indispensable that I should lie and sleep in my usual bed, as on other nights. Fig. 3 shows the result of various modified observations on myself and other persons. From the morning forward, the Od increased on my right hand, some interruptions through hunger being left out of view, through the whole day till at least six o'clock in the evening, at latest till nine. It now most distinctly turned, and fell continually till two or three, A. M., when it attained a stable minimum, which endured to break of day; at the time of the experiment about five to six o'clock. Then, however, as the grey dawn drove away the darkness, the force was at once aroused, and fresh life reinforced the organic world; Od and vital force increased anew throughout the whole day as long as the sun sent down rays from heaven.

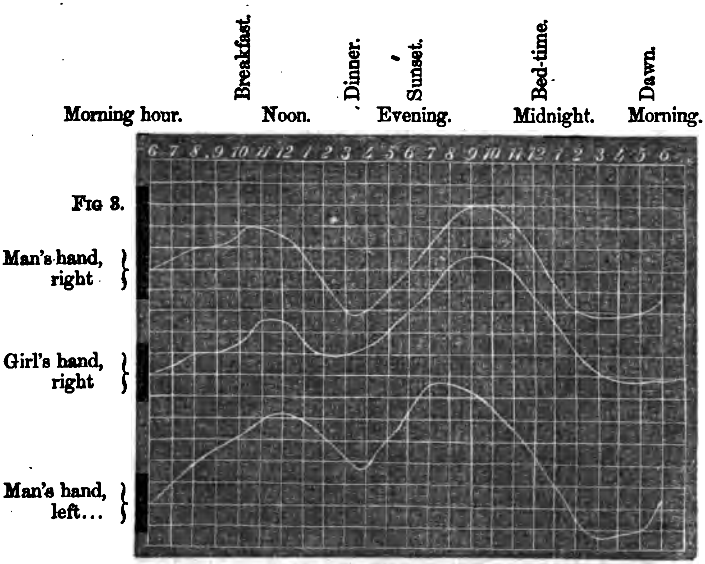


FIG 3.

262. Here, also, I was permitted to find confirmation of a law dis-

covered earlier in a different way. The sun, the one great source of Od, sends it to us with light and heat, and thus, throughout the whole day, imbues with it all that it shines upon. *Directly the sun sinks below the horizon, the odic tension sinks in the human organs*, and with commencement of this change comes also to living human beings, weariness, dulness of the senses, and sleep. *When the od-spring of day ceases to flow, the fountain of conscious waking life becomes dried up.* Not by light and heat alone does the sun call all life into existence, but it uses another potentiality as a lever, the Od, with which it impenetrates all things, even as with heat, and the fluctuations of which we are now beginning to learn how to compare and measure with the conditions of sleeping and waking. That it makes little difference here, in general, whether the sun's rays fall upon us directly, or we are in the shade, follows from the law of conductibility and distribution, as we have already learned; and wherever we may be, a proportionate share of the Od which the day brings will fall upon us.

263. But what are the conditions of the left hand here, which is oppositely polar? Will it increase and decrease in positivity in the same proportion as the right gained and lost negativity? This can only be made out by making both hands the subjects of observation simultaneously, and noting down their odic condition at the same time. Fig. 4, shows how this was carried out. The lower line shows the course of the negative right hand, the upper that of the positive

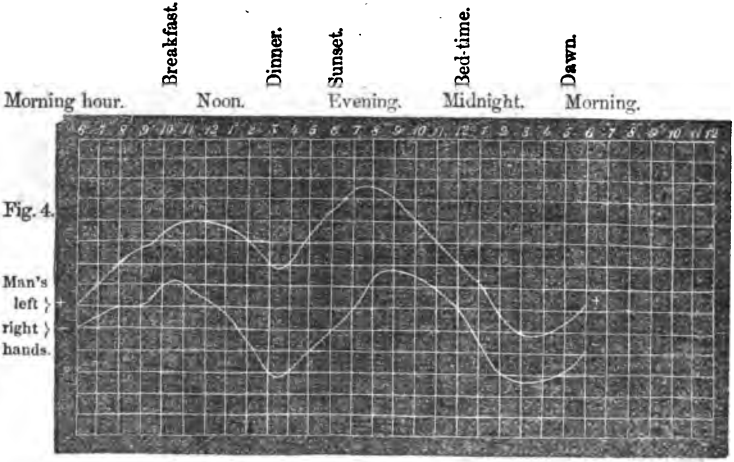


Fig. 4.

left. This latter exhibits a more rapid increase of positive od in the morning, and again a higher elevation in the afternoon, till seven o'clock, than the negative right. The midday hunger period does not show so deep a decline as in the right. It makes the smaller maximum, at midday, somewhat later, the evening one somewhat earlier, than the right. It appears to correspond to a greater energy of development of Od.

The od-positive left hand, therefore, does not follow exactly the same, but still a very similar ódic course, with the od-negative right, taken in the protensive point of view (in regard to changes of tension. —Ed.)

264. The brain has so symmetrical a structure that when such great inner differences appeared in the symmetrical hands as to form a perfect contrast, I could not but reflect on the deeper lying mechanism of human beings, of which the hands are but the outstretched levers. The brain, which many try, not always very happily, to plan out according to its bony shell,* might it not, perchance, be also

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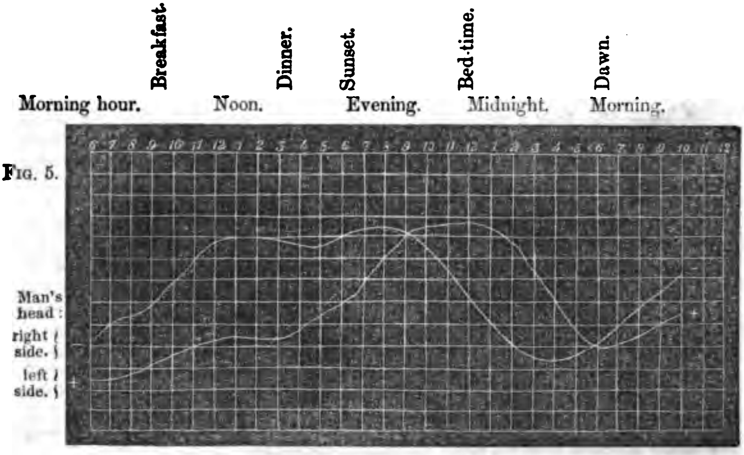
* Those who, from a very numerous series of facts, have possession of a truth, however much they may be in advance of the convictions of their age, can afford to allow the pleasure and the privilege of a sneer to even so profound a thinker as the Baron von Reichenbach. The sentence, to which this note refers, is unworthy of him; but we must remain content that the time must come, when further experiments, with the odic forces, will convince him of the absolute truth of Gall's ideas, published in the great work which, for its vast display of genius, sheds a lustre on the nation claiming him among its offspring. The odic flames emitted from Gall's brain have reverberated from countless orbs in space, and will enlighten the philosophy of the 19th century in this our planet; (see a little brochure entitled, the Stars and the Earth, published by Baillière: also Deleuze, Mémoire sur la Faculté de Prévision, Paris, 1836, page 33.) No case could be better calculated to ensure a conviction of the truth of phrenology than that of Miss Reichel—odically tested, in a state of full vigilance, on several organs of the brain. It is not every one who has the power of concentrating his ideas, and of willing intensely. I have this power to a limited degree, but it is combined with a heavy influence from the brain, which overpowers most impressionable subjects, to a condition of heaviness and stupidity, interfering with the clearness, and cleanness, or sharpness of the results. My friend Mr. Thompson, of Fairfield Lodge, on the contrary, has so light and agreeable an influence, when he silently exercises his will, that obedience is yielded to him, by a patient, without a knowledge of the presence of any remarkable change of condition. I have seen him will a gentleman, in a room where eight persons were present, to perceive no one but himself, and the silent mandate has been obeyed. He has, by his will, placed the same individual, then in the light of broad day, in complete darkness. He has made him sit down and sleep in a chair, to which he was obliged to adhere by an ungovernable force, and then he has played with his will upon several of the organs of his brain in succession, obliging him to manifest the pathognomy of each in its turn. If the fluid of the human will, the odic force, can do this in the case of Mr. J. B. C., will it not be equally possible to perform the same experiment, on the phrenological organs of Miss Reichel, in Vienna? A large crystal,

gifted and imbued with the delicate potentiality of Od, and make itself as perceptible to such delicate reagents as our sensitives are? Miss Reichel found the right side of my skull cool, exactly like my right hand, but much stronger, while the left side was warm. This was the case, not only in me, but in all other persons whom I subjected to the investigation, male and female, all alike. I may especially mention M. Th. Kotschy, who allowed Miss Reichel to make an accurate examination, and whose head, sides, and hands, she found to agree exactly qualitatively with mine. This appeared to me really much more worthy of a fundamental examination than the hands could be, and therefore I repeated the twenty-four hours' inquiry on two different days and nights, on the eighteenth and the twenty-third of October, 1844. Fig. 5 shows the course, the continuous line indi-

FIG. 5.



held with its point, in turn, towards each individual organ, would make Miss Reichel manifest the faculty of that organ. It is essential with some,—so delicate an instrument is the human brain, even with the protection of "*its bony shell*,"—not to perform such experiments as these for too long a period at one time, and to avoid too hasty a transference of the Od force from an attractive to a repulsive organ. Insanity has resulted, from eager or careless ignorance, where the subject has been very impressionable. I have known melancholy instances of this fact. The obvious cure bears out the Baron's philosophy, that in Nature, the Od force positive (or, according to my view,* attractive) is engaged in growth or progress in advancing life. It has energy for its type, while the contrary pole tends to death, or retardation—sluggishness of action. The march of healthy progress has the allied forces of our amiable feelings, sacred morals, and good incates the path of the first investigation, the dotted of the second, which could only be carried to ten o'clock in the evening.

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* Zoist, vol. iv., p. 254, *et seq.*

265. This operation furnished remarkable acquisitions. It showed that as an unequal course occurred at the same times in the hands, so, also, did it to a far greater extent in the two sides of the brain. The left side increased in strength much more slowly than the right in the morning; till toward three o'clock, it was scarcely of importance; while the right had already attained its first maximum at one o'clock, which was scarcely inferior to that it attained in the evening. The weakness from hunger, before dinner, existed on both sides, but far smaller than it showed itself in the hands. While the right side advanced almost on a level till nine o'clock, the left rose unceasingly from three till eleven, P. M. The right began to sink already about eight, P. M., to cross the left and fall deep below it, while the left did not begin to descend from its culmination till one, A. M.; that is, five hours later. The morning rise was, however, almost simultaneous.

The conclusions to be drawn from this, are: *the course of the brain is, on the whole, analogous to that of the head:* increase in the morning; at noon a temporary decline; upper culmination in the evening, and lower culmination about four, A. M., agree pretty nearly with each other, and thus probably with the daily course of the whole organism, in a mode of life like mine. But the brain exhibits a difference from the hands, in the far smaller participation in the influence from hunger, and the satiation of the stomach. *The organs of the understanding and soul appear to take less notice of the crude nutrient operations, than the matter-ruling hands.**

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tellects, characterized by vivacity, cheerfulness, benevolence, and charity; while the repulsive agencies of bigotry, tyranny, and the evil influences of pride, cunning, and suspicion, are characterized by a melancholy desire to coerce and destroy all opposed to their leaden powers. The Baron, an enemy to superstition, should study Gall's Philosophy, which he will find to be a series of truths, in full harmony with all other noble truths capable of being illustrated by the brilliant light of the Odic force.

* Again, to direct attention to the philosophical views of Gall. "*The organs of the understanding,*" under the circumstances here detailed, have no greater relation to "*the crude nutrient operations*" than the organs of sight, hearing, smell, taste, and touch. Each portion of the brain has its destination, and the presence and emission of the odic force, beautifully shown, with the Baron's usual ingenuity, to be dependent on the relative circumstances of the individual, may be inferred to be accumulated or increased in parts, according to the energy with which those parts act, at various periods of the day, or under various circumstances, stimulating the parts to activity. The progress and culmination in the two opposite courses are just those which are observed in the activity or lethargy of the organs at the fore and back parts of the head. Reichenbach tells us. §266, that "the fore and hind parts of the head are more different, anatomically, than the right and left sides of the brain," and his researches have estab-

In fact, nature has done well to provide that the forces of the soul, pre-occupied with cares, should not decline immediately that food is wanting. The difference of the two sides of the brain between themselves, shows us that the right side inclines to sleep much earlier than the left, as well as rises to the strongest animation much earlier in the morning than the latter: therefore, betrays generally a greater excitability, but not greater strength, than the left.

266. The fore and hind parts of the head are more different, anatomically, than the right and left sides of the brain, and I was desirous of bringing this opposition also to the test of the present researches. This operation was also performed twice, on the 19th and 20th of October, each time through twenty-four consecutive hours, and it is expressed in Fig. 6. Here the differences offered a stronger contrast.

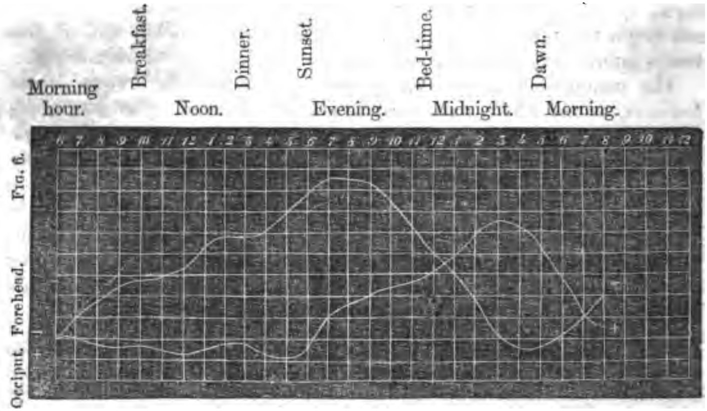

Fig. 6.

The forehead in general manifested cold, the back of the head considerable heat, and this not only in men, but in animals; it occurred so in the house-cat, and when from the hint this afforded, I led the observer to my stables, she found it also in the horses and cows, especially a strong warmth in the hollow of the neck of the last. The forehead of human beings became in like manner greatly exalted in the morning, with the dawning of day, took but small share in the effects of the matutinal and mid-day periods of hunger, and reached

lished just that which might have been expected from Gall's demonstrations of the functions of these two parts. Gall doubted the discovery of Mesmer Reichenbach appears to be ignorant of the deep truths contained in the works of Gall: and yet, by establishing the existence of the odic force, he has placed his Viennese real on the most important science that can occupy the attention of man.

its culmination after sunset. During the whole of this time the back of the head remained almost unchanged, so that at six o'clock in the evening it was exactly in the same place as at six o'clock in the morning. But then it suddenly arose, almost at the same time that the forehead began to enter upon its retrograde course.

From this point forward, they are seen to cross diagonally, and while the back of the head continually rises until three, A. M., the forehead falls incessantly till about the same hour; the one to reach its upper, the other its lower culmination, almost at the same moment. From this point, again, the opposite course commenced, and while, after three o'clock, the exalted back of the head fell rapidly, toward four o'clock the deeply depressed forehead began in like manner to rise quickly.

267. This motion is a representation of our waking and sleeping. The forehead represents the functions of waking life; the back of the head, of sleep. The forehead advances with increasing odic invigoration and operative activity, from five in the morning, with break of dawn, to sunset; then it loses the od-spring of the luminary of the day, and sinks again incessantly from its height, until the new day begins to break, when the force comes anew to rejoin it. The back of the head, on the contrary, passes quietly through the whole day, almost without motion: but so soon as the sun has sunk below the horizon, the hour of its nightly labor has struck. Now arises the Morpheus, and with rapid steps he advances, until the first traces of morning's light remind him the forehead is on its way to free him from his work; the back of the head sinks from its greatest to its lowest elevation, at the close of night, just as rapidly and uninterruptedly as the forehead sunk from its, at the close of day. Thus the two not only shew themselves opposed in polarity,—since one is warm, that is, od-positive, and the other cold, consequently od-negative,—but they are as diametrically opposed to each other in their operations as are day and night, waking and sleeping.

268. From this comparison it is seen, that between waking and sleeping, in relation to Od at least, there is not an opposition like that between activity and rest, like that between motion and stillness; but only that *the focus of activity is changed*. The force does not cease to act; it does not diminish, but it removes merely from the front of the brain to the back, and in proportion as the front gives up intensity, the back seizes it. Sleep thus declares itself, not as a decline of the vital activity, but only as a displacement of it. In just the same measure as the vital force is active in the forehead in the day, does it rule in the hinder part of the head during night. Sleep, therefore, is only an alternation in the functions of

our organs and powers; in no way an introduction of any kind to a state of rest of them; and the poets may use the comparison of sleep with death as a metaphor, but the physiologist cannot, in the consideration of organic life.* Vitality is exactly as energetically active in another direction during sleep, as in the waking condition. The business of sleep is governed by the cerebellum: while the forehead suspends its mental labor, and when it takes to it again, to which it is aroused and qualified by the radiations of the sun, the back of the head lowers its claims upon the vital force.

269. A small accessory, but yet not contemptible support to this, is afforded also by Fig. 7. I had become sleepy soon after dinner, and resting my head on the back of my chair, I slept for ten minutes. During this, and shortly before and after, the sensitive observer felt my right hand. The result is shown in the diagram, marked distinctly between four and five o'clock. While on all other days, the force increased continually during this time, it here made

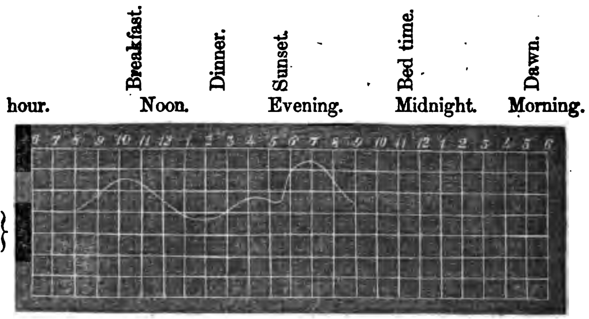

FIG. 7.

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* Dr. Elliotson says, "I have often seen the eyes close forcibly in the mesmeric sleep-waking. It is usually thought that in sleep the eyes close from the relaxation of the muscles of the lids, exactly as the head drops, and the whole body ceases to support itself. But I believe that they close from the contraction of the muscles, just as the iris somewhat contracts at the moment of falling asleep, or of shutting the eyes, and remains contracted, and the raising muscle of the eye (levator oculi) contracts at this moment, rolling the eye somewhat upward, and remains contracted: two circumstances proving that sleep is not a purely passive state, but active in regard to the muscular portions of the eye itself. In falling asleep and on first waking, we feel not a weakness, but a stiffness of the lids; the lids appear to close actively, and the under lid ascends a little at the moment of final closure; and this cannot be the effect of relaxation, but must result from contraction, and the case of the upper lid cannot be supposed to be different from that of the lower, which conspires to the same purpose with it."—See *Zoist*, No. IX., vol. iii., pp. 44–45. *Observations by Dr. Elliotson.*

an anomalous leap downward, but then rose again normally. Therefore, the short sleep into which I had fallen had sufficed to produce a very perceptible change in the distribution of the Od in me; as long as it endured, the manifestation of odic force in the hand rapidly diminished; the ordinate of the force was shortened, and then increased again when I awoke, and all the vital functions again took up their previous directions.

270. The pit of the stomach is a region of the human body which plays a very peculiar part in the somnambulists. Anatomical investigations have been made by many, to find a peculiar organ there, and it has been surprising that nothing special has been met with, to which could be attributed the extraordinary effects, that very often occur, at the pit of the stomach, in the so-called clairvoyants. Neither have Pacini's corpuscles, which have been the most recent things referred to in this question, any distribution in the body, of such arrangement as to correspond with the relative strength of the sensitive parts of the body. But it is not at all necessary that a special organ should exist, in which special concentration of odic phenomena should be met with. At such points, where nature acts with the all-penetrating dynamics, no such palpable apparatus is requisite. They are the combined results of innumerable many-branched components, constituted by the nerves, plexuses, ganglia, &c.; the point of most concentrated affectiveness may fall, therefore, where it will, be it the most unimportant part of the belly. My desire to become acquainted with the course the Od followed in the pit of the stomach was very great. I succeeded in bringing about a twenty-four hours' investigation on myself. Figure 8 shows the result. The line, which represents this, varies but little in its curves from that of the hands.

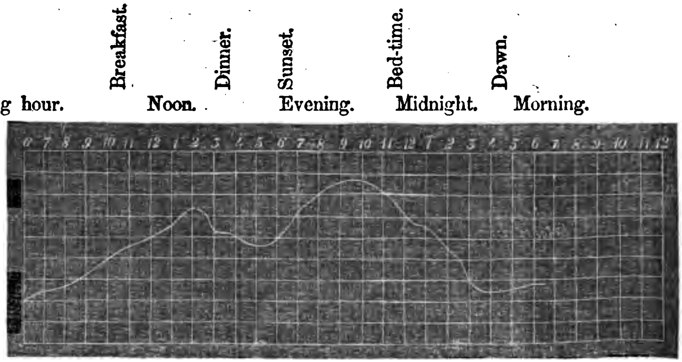

FIG. 8.

The distinction is shown merely in some changes of time and partial postponement. The effect of hunger began first at two o'clock, but extended far beyond dinner-time, to five o'clock. The evening culmination, too, did not happen at sunset, but at ten, P. M. The course of the pit of the stomach thus did not afford anything special, but supported the doctrine that the series of effects of the sunrise, hunger, satiety, and sunset, are extended in the same way over the lower part of the body. Phenomena of another kind, however, which were produced by emotions of the mind, and reflected on the physical functions, were expressed the more distinctly and definitely at the pit of the stomach. I cannot speak of these until some future period, and must be content here to give a preliminary indication.

271. In order to see whether the course of the development of Od was at all different in the female from that in the male sex, I caused a twenty-four hours' investigation to be made on the right hand of my daughter Hermine. Figure 9, shows that it varies so little from that of my right hand, that the difference might almost be attributed to the inevitable inaccuracies of observation. Therefore in this respect there is no difference between the two sexes.

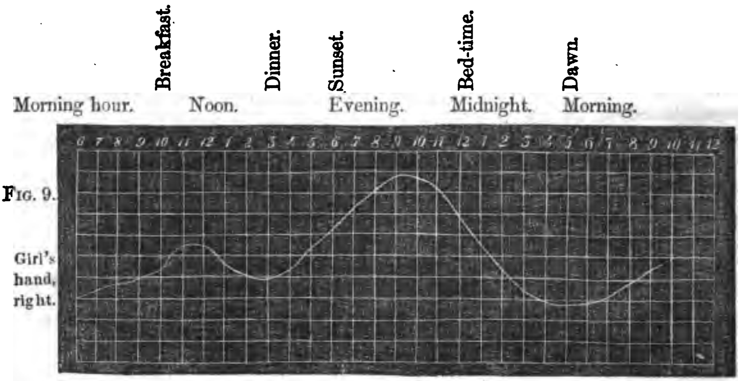

FIG. 9.

Girl's hand, right.

272. Figure 10 is a second support to what has just been said. It is the line of the right hand of Miss Reichel, which she laid down from feeling it with her own left during twenty-four hours. It is to me of value to get possession of the course of the odic phenomena in a highly sensitive person during her diseased condition. The diagram shows that it does not differ in any respect from that of the healthy, and merely deviates in the order of time of the phenomena,

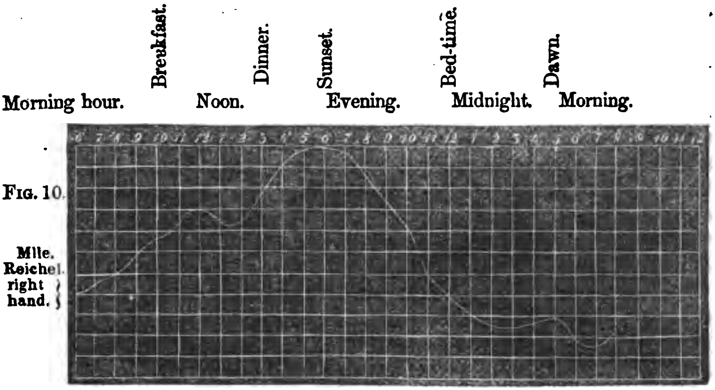

FIG. 10.

in so far as Miss Reichel dined at a different time, two hours earlier than myself and children.

273. On the other hand, there occurred an accessory observation which appears deserving of mention. On the diagram is seen a fresh, sudden, and rapid decline of the force at five o'clock, A. M., just at sunrise. At the very moment when this began, she was suddenly seized with an attack of pain in the stomach, which lasted till seven o'clock. The appearance of this pain not only at once restrained the appearance of odic development, but quickly depressed it to a much greater extent. As soon as it disappeared, the force increased normally.

274. It is also deserving of remark, that although Miss Reichel was never quiet during the whole of this night, but got only, now and then, some seven or eight minutes of light sleep; nevertheless, as the figure shows, the entire nocturnal period, from sunset to sunrise, afforded the same contrast of daily increase, and nightly decline, as in the healthy, who are completely buried in sleep.

275. From this last series of investigations many further physiological truths may be deduced; I will here only bring forward a dietetical theory. If the day with the sunlight and the increasing Od in the forehead and hands is appointed for the voluntary intellectual functions, and the night with the then declining Od, which now removes to the back of the head, to the more unconscious vegetative functions, all of what we do and suffer that corresponds to this arrangement of nature must be favorable to our constitutions and to our health; on the contrary, all that contradicts it must be obstructive and injurious to our welfare. Taking food is, as we have seen, favorable to the increasing Od in the forehead and hands; the effect

of the chemical action arising from this unites itself with that of the sun's rays, and, in conjunction, they elevate the development of Od, and with that the active force of daily life. We therefore promote our welfare when we eat in the day, even as nature has appointed the day-time for it. But the chemical action of digestion continues for several hours; it may therefore happen, that we shall take food at such a time of the day, that the digestion will be prolonged into that time when the sun's rays have already disappeared, and the Od, consequently, is sinking in the hands and forehead. Then, the effect of the increasing Od, from the chemical decomposition, would run directly counter to that declining from the absence of the sun. This would cause a conflict in the organic actions. Thus, a new theoretical ground, that is, an explanation, is afforded of the old practical experience, that one should not eat in the evening, and in general not for several hours before going to bed; and that if this be done, imperfect sleep, with restless dreams, *i. e.* half-consciousness, semi-activity of the front of the head, will be the consequence. It might be thought that the developed Od would then withdraw to the back of the head, and thus favor sleep; this, however, not only contradicts the general experience, but also the special observation here upon me. For, by the experiments and diagrams, it is shown that in Miss Reichel, who took dinner at one o'clock, the decline of the Od in the hands, together with that in the front of the head going parallel with it, commenced exactly at sunset; while in myself and my daughter, who did not dine until three, P. M., the same decline began about eight or ten o'clock; thus just as much later as we had taken our meal. In Miss Reichel, therefore, the stronger development of Od from the chemical action of digestion had already ceased when evening arrived; while in myself and my family it endured some hours beyond, and in some cases made equilibrium against the decline of that Od coming with the sun (heliod;) sometimes exceeded it in strength. Therefore, whoever wishes to go late to sleep will do well to take the principal meal at a proportionately late hour of the day.

276. But he who does this acts in opposition to the natural arrangements of the animal functions, and certainly injuriously affects the duration of his health. It is known from other experience that the sleep before midnight is the deepest, soundest, and most strengthening, and cannot be replaced, to equal benefit, by any arbitrary supplement in other hours. The above researches indicate strengthened reasons for the explanation of this. Nature has appointed the order for the whole animal, and apparently the vegetable world also, with few exceptions, that with the departure of the sun's rays, with the reversal of direction of Od in the organism, sleep also should appear;

and *vice versâ* that it should cease when the sunbeams and Od return to the forehead. If we go to bed late at night, we must sleep long into the day next morning. But then we have the course of the heavens, and with this the odic direction, against us, and the morning sleep does and must, for the same reason, be bad and unrefreshing; which it will also be, when we go to sleep with a newly-filled stomach: we are under the influence of a false direction of the odic development. People who go to bed and rise late, are, on this account, generally more languid, and more deficient in cheerfulness in the morning, than those who accommodate their mode of life to the order of nature. From all this it results, that whoever wishes to insure the duration of his health, with regard to the course of nature, which has such a profound influence therein, must rise at latest with the first rays of the sun, take the principal meal best at eleven or twelve o'clock, but never after one, eat little or no more later in the day, and go to bed at twilight. Thus do all animals, thus does half savage man in the state of nature, thus do all the poor and needy in the country; only the so-called enlightened people of our towns do better: they sup at ten or eleven at night, go to bed at two or three o'clock, and afterwards send for the physician for gout, scrofula, and spleen.

Throughout the present treatise, we meet, in all the observed phenomena, without exception, a condition in which the Od displays itself through excitation of sensations either of tepid warmth or coolness. We are able to distinguish four kinds of modification, in the conditions in which we are able to detect and discover it, by means of these impressions on the sense of feeling. *First*, namely, it occurs introduced into bodies from without *by transfer*, and then depends upon other odic objects, through the actual contact or mere approximation of which, the Od has been conveyed to or excited in it; to which belong, therefore, reception of the rays of the heavenly bodies, as well as alteration of aggregation by friction, chemical activity, or heat. Odic quality derived in this way is but temporary, and of short duration. *Secondly*, it resides in *amorphous matter as an independent quality*, and then is not very strongly expressed. *Thirdly*, it occurs in amorphous substances, as in magnetized steel, *impregnated by transfer in conjunction with magnetism*; not, however, escaping rapidly, but holding to the object as long as it remains magnetic (§ 23, note). *Fourthly*, it appears accumulated in *particular points*; as in crystals, plants, and animals, and is then of constant duration.

In the first two cases the Od presents itself *like the simple electrical charge*, uniformly distributed in the bodies; in the two last we find it *like the voltaic pile*, presenting a polarity in bodies, and not merely in the direction of one single axis, but, and especially in organic structures, in those of many intersecting ones.

The Od, therefore, possesses a manifest dualism, which presents an unmistakeable resemblance in kind to electricity.

RETROSPECT.

a. The terms "tepid" and "cool," "warm" and "cold," in the mouths of the sensitive, are not to be taken literally, but figuratively. They express a sensuous perception, which is similar to those which tepid warmth and coolness usually produce in us.

b. In crystals and magnets, one pole almost always gave them a warm, the other a cool sensation.

c. The warm pole is, as a rule, Od-positive, and may be denoted + Od; the cool pole is Od-negative; therefore in like manner by — Od.

d. The lifeless, amorphous, material world, forms a great series, at one end of which occurs the most od-positive body (as yet potassium), at the other end the most od-negative (as yet oxygen), and which proceeds from the greatest odic tepid heat to the greatest odic coolness, and thus represents an odic series of all matter.

e. Positively electrified bodies diffuse odic coolness; negatively electrified, odic warmth, or else diminished coolness.

f. Heating a body produces manifestations of + od; cooling, of — od.

g. Friction produces + od.

h. All kinds of fire diffuse — od.

i. From the effect of chemical activity, as such, — od is always immediately given out.

k. All odic flames emitted from od-positive bodies feel warm, all from od-negative, cool; the odic temperature of their flame-like emissions, therefore, gives a measure of their odic value.

l. In plants the *caudex descendens* has been found, on the whole, to be od-positive; the *caudex ascendens* od-negative; but in detail, each single organ is polarized.

m. In man, the whole left side is od-positive, the whole right od-negative. This polar opposition is, especially, distinctly manifested in the hands, and ends of the fingers.

n. Men and women are polarized in the same way.

o. In human beings, both male and female, the odic intensity displays a difference, at different times, and in different dispositions, arising from hunger, satiety, sleep, disease, &c., sometimes increasing, sometimes declining.

p. When brought into the sphere of action of the objects diffusing Od, sensitive human beings are only comfortable when their own od-polar parts are placed opposite to the foreign od-poles of the opposite name; when opposed to those of the same name, discomfort, and then indisposition, arise.

q. There exist in bodies conditions of enduring and temporary odic charging, similar to analogous electrical conditions; in the first is found a decided, but in the second no perceptible dualism.

CONCLUSION.

The experiments and observations detailed in the foregoing seven treatises, and the deductions drawn from them, when briefly summed up, yield the following axioms in physics and physiology:—

1. The world-old observation, that the magnet reacts sensibly on the human organism, is neither "lie, deceit, nor superstition," as many naturalists at present think and declare; but is a well-grounded fact, a manifest physico-physiological law of nature.

2. It is a tolerably easy matter, one that may be carried out anywhere, to attain conviction of the correctness and accuracy of this; for people are to be met with everywhere whose sleep is more or less disturbed by the moon, or who suffer from nervous indispositions; almost all these experience the peculiar excitation by the magnet, to a considerable extent, when it passes down them from the head over the body. Still more frequent are healthy and vigorous persons, who feel the magnet very vividly; many feel it more weakly; many detect it, but in a very slight degree; finally, the majority cannot perceive it at all. All those who detect this reaction, and they appear to constitute a quarter or a third of the human race, are here denominated by the general term of "sensitive." (§ 66.)

3. The perceptions of that influence present themselves, chiefly, to the two senses of feeling and sight: to the feeling, by a sensation of apparent (§ 217) coolness or tepid warmth (§ 225); to the sight, by appearances of light issuing from the poles and sides of magnets (§§ 8, 9, 15,) when the patients remain, for a long time, in deep obscurity.

4. The capacity to exercise such influence presents itself not only in the steel magnet, which we produce in our workshops, or in natural magnetic iron, but nature gives evidence of it in an infinitely varied number of cases. In the first place, there is the entire globe, which, through terrestrial magnetism acts more or less powerfully upon sensitive persons (§ 60, &c.)

5. Then there is the moon, which, by means of exactly the same force, reacts towards the earth, and thus towards the sensitive (§ 118.)

6. Further, all crystals, natural and artificial, and those in the direction of their axes, (§§ 31, 33, 35, 50, 55.)

7. In like manner, heat, (§ 121.)

8. Friction, (§ 127.)

9. Electricity, (§ 159.)

10. Light, (§ 131.)

11. The rays of the sun and stars, (§§ 97, 208.)

12. Chemism, to an especial extent, (§§ 137, 142.)

13. Then the organic vital force, both in *a*, Plants, (§ 25); and also in *b*, animals, particularly man, (§ 79.)

14. Finally, the total material world, (§§ 174, 213.)

15. The cause of these phenomena is a peculiar natural force, which extends over the whole universe, (§§ 213, 214,) different from all hitherto known forces, and here designated by the word "Od," (§ 215.)

16. It is essentially different from that to which we have hitherto applied the name of "Magnetism," (§ 42,) for it does not attract iron, (§ 37,) nor magnets, (§§ 24, 38); bodies charged with it are not determined in particular directions by the terrestrial magnetism, (§ 42); they do not affect the suspended magnetic needle, (§ 38); they are not disturbed, when suspended, by the vicinity of an electric current, (§ 39); and they do not induce any galvanic current in metallic wires, (§ 40.)

17. Though different from what we call magnetism, it presents itself in all places where magnetism appears, (§ 43.)

18. But, on the other hand, magnetism by no means appears everywhere that Od presents itself; this force, therefore, has a proper existence, independently of magnetism: magnetism, however, is never free from a connection with Od, (§ 43, 44.)

19. The odic force possesses polarity. It appears at the two poles of the magnet with constantly different properties: at the northward (§ 225, Note) it produces a sensation of coolness in the feeling, as a rule, in the pass downward, and in darkness a blue and bluish-grey light; the southward pole, on the other hand, a sensation of tepid warmth, (§ 225) and a red, reddish-yellow, and reddish-grey light. The former is connected with a decided pleasure, the latter with discomfort and uneasy pains. Next to magnets, crystals (§§ 32, 50, 55, 220, 221) and living organic beings (§§ 84 to 89, 253) exhibit the odic polarity most distinctly.

20. In crystals, the odic poles occur at the poles of the axes (§ 32); in crystals with several axes, there are several odic axes, of unequal strength.

21. In plants, the ascending trunk is, as a whole, opposed in polar quality to the descending; but there are countless other subordinate polarities in all the separate organs. (§ 248, et seq.)

22. In animals, at least in man, the entire left side stands in odic opposition to the entire right (§ 226). The force is concentrated into poles at the extremities, in the hands and fingers (§ 254); and in the two feet (§ 23); more strongly in the former, more weakly in the latter. Within these general polarities, however, occur countless minor subordinate special polarities of the individual organs as opposed to each other, and as exhibiting an independent bi-polar condition in themselves (§ 254.) Men and women do not differ qualitatively in the odic characters (§ 227.)

23. On the globe, the north pole is regarded as positively magnetic, the south pole as negatively; in accordance with this, the northward pole of the suspended needle as negative, the southward as positive. In agreement with this, I have taken the south pole, which goes with the negative magnetic pole, in like manner for negative, "od-negative," = — od; the other, opposite pole, for "od-positive," = + od. (§ 231.) In crystals, therefore, the pole giving the cold downward pass, is od-negative, the warmth-giving, od-positive (§ 231.) In plants, on the whole, the root is od-positive, the stem and its apex od-negative (§ 252.) In man, the left side, its hand and finger-ends, are warm, disagreeable, and red-luminous; therefore od-positive: the right side, hand and finger-ends, are cool, pleasant, and emit a blue light; therefore are od-negative (§§ 226, 231.) It will not differ in any animals (§ 253.)

24. In direct sunlight, the red ray and those below it appear od-positive, the blue and those above it—that is, the so-called chemical ray—od-negative; the spectrum is, therefore, odically polarized (§ 116.)

25. Amorphous bodies, without crystalline arrangement of their integral components, exhibit no separate polarity; but each acts singly, within its limits, as odically warm or cold to the feeling; and this reaction exhibits different degrees of intensity in different substances, so that they thus arrange themselves in succession, and form a continuous chain of gradations, in the same way as they form a series according to their electrical nature, which we call the "electro-chemical." Exactly in the same manner do all simple substances combine in an odic series, which has the strongest positively od-polar bodies at one end, as potassium, &c., and at the other, the strongest od-negative, like oxygen, &c. And since this natural grouping appears almost to coincide with the electro-chemical, it may be called the od-chemical series (§ 236.)

26. Heating (§§ 122, 245) and friction (§§ 129, 246) display + od; cooling (§ 123) and the light of fire — od. (§§ 131, 240, 244.) — Chemical action varies, in its odic value, according to the charac-

ter of the substances brought into action (§§ 139, 142, 247.) But, in far the greater number of cases, they have hitherto been found od-negative.

27. Of the heavenly bodies, those which have no proper light, as the moon and the planets, appear od-positive in their principal effect (§§ 119, 208, 239); those which are illuminating, like the sun and fixed stars, od-negative in their chief effect (§§ 100, 208, 239). But the spectrum of them, again, shows itself polarized (§ 116).

28. The odic force can be conducted in bodies; all solid and fluid bodies conduct Od to distances as yet unmeasured. Not only metals, but also glass, resin, silk, and water, are perfect conductors (§§ 47, 81, 113, 118, 121, 141, 167, 203). In a somewhat smaller degree only do less connected bodies conduct: such as wood, paper, cotton stuffs, wool, &c. There are, therefore, some, though only weak, obstacles to the transition from one body to another.

29. The conduction of Od is effected much more slowly than that of electricity, but much more rapidly than that of heat; it may almost be followed, on a long wire, by making haste.

30. Od may be transferred, be brought from one body on to others; or at least a body in which exists a manifestation of free Od, will produce a similarly odically excited condition in another (§§ 29, 45, 72, 82, 105, 118, 143, 198, 202).

31. The transfer is effected through contact. But a mere approximation, without actual contact, suffices for it, though with weaker effect (§ 202).

32. The transference is not performed very quickly, but requires some time, several minutes, for its completion (§ 48).

33. Neither in conduction, nor in transference, does polarity appear in the establishment of Od in the bodies; this appears rather to be an application of a certain molecular arrangement to the matter.

34. The duration of the odic condition in bodies, after complete charging, and the removal of the charging object, is brief, different according to the quality of the material, seldom perceptible, beyond a few minutes, to healthy, vigorous, sensitive persons (§§ 82, 167, 169); sometimes sensible, even after some hours, to diseased, highly sensitive persons; for instance, in magnetized water. Matter, therefore, possesses a certain coercive power over Od (§§ 46, 83, 112, 205).

35. Bodies which have been odized by conduction or charging,—*e. g.* metallic wires,—afford sensible emanations of Od at their opposite extremities; warm or cool, positive or negative, like the poles from which they issue (§§ 107, 114, 119.)

26. Od shares with heat the peculiarity of two different conditions; one inert, slowly making its way through matter, a radiation (§§ 193,

254). In the last condition the Od from magnets, crystals, human bodies (§ 254), and hands, is felt, by healthy sensitive persons, instantaneously, and without any perceptible interval of time, at the distance of a long suite of rooms. All the processes which the inert Od diffuses slowly over bodies are radiated by it, simultaneously, in all directions, but with varying strength; thus friction, electricity, heat, chemical action, matter in general (§201). The rays of Od penetrate clothes, beds, boards, and walls (§ 23, note), but evidently less easily and quickly than magnetism, and with a certain slowness. The conduction and transfer by means of mere approximation of the poles of crystals and magnets, the hands, amorphous bodies of high od-polar rank, &c., appear all to depend on radiation of Od; to which, therefore, belongs also the so-called magnetization of sensitive human beings.

37. Electric currents, conducted through sensitive persons, produce no observable odic excitement, nor do they affect them immediately, perceptibly differently from all other persons (§ 160); but mediately, more strongly in proportion as they produce odic disturbances in other bodies (§ 167). Metals placed within the sphere of electrical action exhibit the most vivid phenomena of Od (§ 168).

38. The light, which odically excited bodies emit, is always weak, and from this weakness, is not visible to every eye. Persons who are not exceedingly sensitive, are obliged to remain for a whole hour, or even two, in absolute darkness, before their eyes were sufficiently prepared to be fit to perceive the odic light, and it was necessary that they should not, during this time, have received a trace of other light. But the cause of this cannot lie in a special acuteness of the eye alone, because all who see Od light are, without exception, gifted with the peculiar excitability to detect the odic impressions by feelings, to distinguish them according to apparent warmth or coolness, according to agreeable or unpleasant sensations, which are not subject to change. Since these different capacities are always all present, simultaneously, in particular persons, or are all simultaneously absent, they must be regarded as connected, and appear to depend upon a peculiar disposition of the whole nervous system, which we are unacquainted with, and not upon a special quality of separate organs of sense.

39. The odic light of amorphous bodies is a kind of inward and outward glow, showing through the entire mass, like phosphorescence, and perhaps depending on the same cause; a thin luminous veil, like a delicate down-like flame surrounds it (§ 207). In different bodies this light occurs of different colors—blue, red, yellow, green, purple, mostly white and grey. Simple bodies, especially

metals, are most brightly luminous (§ 206); compounds, like oxides, sulphurets, iodides, hydrocarbons, silicates, salts of all kinds, glasses, nay even the walls of a room, are all luminous (§ 206).

40. Where the odic light occurs polarized, as in the magnet (§ 3, 6), and in crystals (§ 55), it forms a flame-like stream, issuing from the poles, proceeding almost in a right line from the arms of the magnet, and the axes of the crystals, and spreading out somewhat at a distance from the poles, while it diminishes in intensity of light. It displays all the brilliant colors of the rainbow (§§ 9, 13) but remains predominantly red, at the positive poles, and blue, at the negative. At the same time, magnets, crystals, and hands, like the amorphous bodies, remain luminous, glowing odically throughout their mass, and in like manner surrounded by a fine luminous vapory veil (§ 8).

41. Human beings are luminous almost all over the surface of their bodies, but especially on the hands (§ 92), the palms of the hands, the points of the fingers (§ 93), the eyes, different parts of the head, the pit of the stomach, the toes, &c. Flame-like streams of light of relatively greater intensity flow from the points of all the fingers, in a straight direction from where they are stretched out.

42. Electricity, even the mere electrical atmosphere, produces and strengthens the odic luminous phenomena in a high degree (§ 167); not, however, instantaneously, but after a short pause of a couple of minutes (§ 169).

43. The electro-magnet behaves like the common magnet in regard to the odic light emanations (§ 12); and it is capable of strengthening the luminous phenomena, simultaneously, in just the proportion that it is susceptible of magnetic exaltation.

44. The rays of the sun and moon produce odic charging in all bodies on which they fall; and this, conducted by wires into the dark, gives odic flames at their points (§§ 114, 119.)

45. Heat (§ 125), friction (§ 129), and the light of fire (§ 134,), produce visible luminosity on wires and their points carried into the dark; a flame resembling that of the candle.

46. Every chemical action, though merely a simple solution in water, or a resumption of water of crystallization by effloresced salts, effects exactly the same, in a strong degree, on wires inserted in them (§ 146). But processes of decomposition independently emit odic flames, and diffuse odic glow (§ 145).

47. The positive pole gives the smaller, but more luminous flame; the negative, the larger but less intense; the former became yellow and red; the latter became blue and grey. The odic flame radiates light which illuminates other bodies in the vicinity. It may be col-

lected by glass lenses, and concentrated into a focus (§ 18). The luminous odic emanations of bodies, and their poles generally, must therefore be distinguished from odic light, in the narrower and more peculiar sense of the word.

49. All odic flame may be made to flicker by currents of air; be diverted, caused to wave, blow about, and broken up by blowing on it (§ 20); meeting with solid bodies, it bends round them, follows their surface, and streams forward on them, like flames of common fire (§ 20); it is evidently of wholly material nature.

50. We can give it any direction we please,—upward, downward, toward any side; it is, therefore, up to a certain point, independent of the influence of terrestrial magnetism (§ 20, 23.)

51. The emanations of odic light seek plane and solid angles, and points (§ 3), and, like electricity, find more ready issue there, agreeing with the obstacles to transition observed in conduction; at such places the differences of temperature and luminous phenomena are always manifested in greatest strength (§ 114).

52. The odic flames issuing from opposite poles exhibit no tendency to unite with each other: no perceptible mutual attraction occurs, and thus there is here a total difference from the magnetic agent (§§ 3, 9).

53. All od-positive bodies emit warm, all od-negative cool, odic flames (§ 223). The odic flames, therefore, bear, in reference to the apparent temperature, the character of their pole; and this consequently affords an expression of the odic quality of the body to which they belong (§ 241).

54. In many conditions of disease, especially in cataleptic attacks, a peculiar kind of attraction has been observed, exercised by the od-pole of magnets, crystals, and the hands, for the abnormally sensitive hand (§ 23). It is similar to that of the magnet for iron, but is not reciprocal (§ 24, 54); *i. e.*, the sensitive hand does not on the other side exercise any perceptible attraction for the od-poles (§ 23, 91). Even objects rendered odic by conduction and transfer, produced this strking effect to some extent (§ 28).

55. In the animal organism, night, sleep, and hunger diminish the odic emissions; food, daylight, and activity elevate and increase them (§ 260, 262). In sleep, the focus of odic activity is removed to different parts of the nervous system (§ 268). Within the twenty-four hours of the day and night, a periodical fluctuation, a decrease and increase of it, occurs in the human body (§ 265).

56. Certain applications of the odic laws, discovered in the present researches, have been made, in the partial explanation—of the so-called magnetized water (§§ 27, 28, 73, 105, 112); of the light in

rapid crystallization (§ 55); of the luminous appearance observed over graves (§ 158); of the mysterious affairs in Pfeffel's garden at Colmar (§ 156); of the so-called magnetic tub (§§ 135, 151); of certain effects of digestion (§ 152); of respiration (§ 153); of many strange antipathies of mankind (§ 175); of the necessity of placing sensitive diseased persons in the magnetic meridian (§§ 69, 71); of the attraction of magnets and hands for cataleptic persons (§ 23); of the odic condition of the human body (§ 79, *et. seq.*); of the daily and hourly alterations of this (§ 256); and lastly, of some of the peculiarities and causes of the aurora borealis (§ 21.)

END OF PART I.

PREFACE.

277. It was objected, that the five girls whom I employed as reagents in my former researches, were insufficient, where the question was the establishment beyond doubt of important scientific truths.—I admitted that this might be the case, and endeavored to extend my investigations over a greater number of persons, who should furnish a greater variety of conditions. In this way more than two years have passed by, during which, on that account, the present treatise has necessarily been delayed. Now, however, it appears, with the support of *almost sixty sensitive persons*, men and women, mothers and maidens, children and aged persons, low and high, poor and rich, weak and strong, sick and healthy, menstruating and pregnant women,—a multiplicity of conditions is now represented which can leave little more to be desired. But the most essential accession which the work has received through these, lies in the fact that *perfectly healthy, strong persons* are included in considerable numbers in the list; that men who have never suffered illness, and who have passed their lives in continued hard bodily labor, have perceived the peculiar sensations and the luminous appearances which constitute the object of these researches, exactly in the same manner as young ladies who pass half their lives upon a sofa; that neither youth nor age, sex nor position in life, make any difference, and that the sensitiveness is not a diseased condition, but rather a peculiarity of many persons, which merely appears more or less strongly, or becomes imperceptible, under various circumstances. The subjoined list will show that even more than half the persons who have had the good will towards me and towards the cause of science, to devote themselves to these investigations, consists of perfectly healthy individuals. I have found, to my great astonishment, that the number of the sensitive surpasses all expectation among mankind generally,—that a number of persons, who are far from even suspecting anything of the kind themselves, clearly perceive the *odic* sensations, and the luminous phenomena, after having remained a sufficient length of time in the dark. In fact, this holds now to such an extent, that at

present I scarcely ever require sick persons for my experiments; and it not only suffices to employ the healthy, but I am nearly in a position entirely to exclude the sick, and especially somnambulists. The objection, therefore, that the observations are not supported by sufficient testimony, as well as a second, that the evidence of diseased observers does not deserve full trust, will be answered in the following pages, and must henceforth be given up.

As to the reason why I have not earlier brought forward a greater number of witnesses for my observations, I have already explained this above, (§ 6); I have feared to weary the reader by a superabundance of material. Now, however, that this is pointed to as an imperfection of my work, I no longer hesitate to make use of all the evidence at my command, and thus to place my thesis on the broadest foundation; the same phenomena will be seen to present themselves under the most varied circumstances, and the reader will now be in a better position than before to repeat them everywhere and with facility. For convenience of revieval, I subjoin the

LIST OF NAMES OF THE PERSONS

Who, from their capacity for sensitive perceptions, have supported me in my labors by their co-operation and observations.

Mrs. Cecilie Bauer, wife of an inn-keeper, No. 161, Braunhirschengrund, Vienna.
Miss Leopoldine Reichel, daughter of a civil officer of Schönbrunn.
Miss Maria Atzmannsdorfer, daughter of a military surgeon.
Miss Angelica Sturmann, daughter of the director of an hotel.
Miss Francisca Weigand, daughter of a hatter, No. 60, Windmuhl, Vienna.
Friedrich Weidlich, naval invalid.
Miss Josephine Winter, daughter of a painter at Gratz.
Miss Marie Nowotny, daughter of a subaltern civil officer.
Miss Clementine Girtler, daughter of a merchant.
Mrs. Francisca Kienesberger, wife of a steward of a manor.
Mrs. Johanna Lederer, widow of a government official.
Miss Maria Maix, daughter of an official, No. 260, Kohlmarkt, Vienna.
Miss Josepha Zinkel, daughter of a householder at Nutzdorf, near Vienna.
Baron August von Oberländer, at Schebetau, in Moravia.
Mr. Nicolaus Rabe, government official of the Montan exchequer.
Miss Amalie Krüger, daughter of the superintendent of an hotel, No. 27, in the Leopoldstadt, Vienna.

Miss Wilhelmine Glaser, daughter of an innkeeper at Bochtitz, in Moravia.

Alois Baier, tradesman in Vienna.

Mrs. Johanna Anschütz, wife of M. Gustav Anschütz.

Dr. Nied, physician in practice, No. 396, Erdberg, Vienna.

Mr. Sebastian Zinkel, householder in Nussdorf, near Vienna.

Miss Johanna Kynast, daughter of a baker, of Waidhofen, in Austria.

Miss Leopoldine Atzmannsdorfer, called Dorfer, daughter of a military surgeon.

Mrs. von Peichich-Zimanyi, widow of a Hungarian noble.

Johann Klaiber, joiner, in my service.

Miss Wilhelmine von Weigelsberg, No. 451, Wieden, Vienna.

Baroness Maria von Augustin, wife of Baron von Augustin, major in the imperial service.

Miss Sophie Pauer, daughter of the Consistorial Counsellor Pauer, Vienna.

Professor Dr. Stephan Endlicher, Director of the Imperial Botanic Garden, member of the Vienna Academy.

Mr. Franz Fernolendt, chemical manufacturer in Vienna.

Anka Hetmanek, field laborer on my estate, Reisenberg.

Miss Ernestine Anchütz, and her brother.

Mr. Gustav. Anschütz, artist, No. 268, Ferdinandsgasse, Wieden, Vienna.

Mr. Stephan Kollar, junior.

Friedrich Bollmann, cabinet-maker, (blind.)

Mrs. Josephine Fenzl, wife of Dr. Fenzl, curator in the Imperial Museum.

Mrs. von Varady, wife of the Aulic Counsellor von Varady.

Mr. Johann Studer, agriculturist, of Zürich.

Baroness Pauline von Natorp, wife of Baron Natorp, Vienna.

Chevalier Hubert von Rainer, barrister of Klagenfurth.

Mr. Ernst Pauer, Consistorial Counsellor, and superintendant of the Evangelical Communion in Vienna.

Mr. Wilhelm Hochstetter, of Esslingen, gardener at Schönbrunn.

Baroness Isabella von Tessedik, widow of a Hungarian noble and court secretary.

Mr. Demeter Tirka, merchant in Vienna, (a Greek.)

Miss Elise von Seckendorf, at Sondershausen, Saxony.

Mr. Constantine Delhez, philologist, Vienna, (from Belgium.)

Mr. Theodore Kotschy, the well-known traveller in Africa, Persia, &c.

Maximilian Krüger, orphan from the Asylum, Vienna.

Hermine Fenzl, infant daughter of Dr. Fenzl.

Mr. Karl Schuh, physicist, from Berlin.

Dr. Friedrich, from Münich.
Dr. Ragsky, professor of chemistry in Vienna.
Mr. Mathias Mauch, veterinary surgeon, from Wirtemburg.
Professor Rössner, imperial counsellor at the Academy of Fine Arts, Vienna.
Mr. Edward Hütter, bookseller in Vienna.
Mr. Franz Kratochwila, government official.
Mr. Franz Kollar, curator in the Imperial Natural History Museum.
Miss Susanna Nather, daughter of an officer of Basle, now in Vienna.
Professor Dr. Huss, physician in ordinary to the King of Sweden.
My daughter Hermine.
Dr. Diesing, curator in the Imperial Natural History Museum.

Almost all these persons are in Vienna, and may at any time be questioned or heard. The order in which they are here enumerated, corresponds pretty nearly to a decreasing scale of the intensity of their sensitive irritability.

278. In the first place I have to premise a word or two upon another subject. In the whole course of the preceding seven treatises, I have everywhere (§§ 34, 225, &c.) assumed the north pole of the earth to be positively magnetic, and the south pole of our planet negative, and considered all other polarities, of steel bars, crystals, living organs, &c., in accordance with this pre-supposition. Since physicists are not agreed which of the two poles of the earth and the magnet to regard as positive and negative, and the text-books are either wholly silent on this head (*Biot*, *Pouillet-Müller*, *Baumgartner*, and others), or directly contradict one another (*Eisenlohr*, Physics, 3rd edit. p. 461; *Eydam*, Electricity and Magnetism, p. 152), one calling + M what the other sets forth as — M, and since uncertainty thus prevails over the value of both powers, it appears necessary that I should briefly explain the reasons which determined me in my choice.

In the electro-chemical system which Berzelius introduced into natural science, and thereby gave its present form to chemistry, the voltaic zinc and copper pile is, it is well known, taken as the basis, and the electricity of the zinc pole is regarded as positive, because it agrees in its properties with those which glass rubbed with zinc amalgam presents, and which have been called positive. It is further agreed to consider all those bodies, which collect in preference around the positive pole, in the voltaic current, as electro-negative, and *vice versâ*. With this clue, I have endeavored to investigate the *odic* properties which present themselves, on the one hand in the electro-negative, and on the other in the electro-positive bodies. The great, strongly expressed *odic* distinctions between the two, as I have made them out and detailed them in the preceding treatises, I have again perceived in a similar manner at the poles of crystals, in organic beings, in magnets, &c. A parallel has thus been distinctly evolved, to be drawn between certain properties of one pole of these natural objects, and those of the other. Those, therefore, which are parallel to the properties of the electro-negative bodies, I have assumed to be equivalent with these as to their polar value, and called od-negative, and *vice versâ.* That pole of our magnetic needles which turns to the south, and which I have everywhere denominated the southward pole, is the one which in odic respects produces the same reactions as the electro-positive bodies. This, however, is the magnetism of the north pole of the earth. Under the general hypothesis, therefore, that in the electro-chemical series, the metalloïds are actually negatively electrical,—most metals, on the other hand, positively electrical, —I have been compelled to decide in favor of those who regard the north pole of the earth as positively magnetic, to indicate it as + M, and consequently to mark all analogous odic properties with + Od. In like manner I have necessarily assumed the south pole of the earth to be negatively magnetic, indicated it by — M, and called the odic phenomena going parallel with it — Od.

Although I have declared for the electro-chemical theory now prevailing in my judgment as to the nature of the magnetic-poles, and have deduced their value by conclusions from this, I am perfectly aware that the polar signification of natural bodies is still an unsettled subject, that doubts may be urged against the negativeness of the acids and the positiveness of the alkalies when we see the two in contact polarized in a directly opposite manner, &c.; in the course of my investigations also I have in many places perceived obstacles to it; but I have submitted to the generally received opinion, and in compliance with this the north pole of the globe must be called positive and the south pole negative, so long as potassium is acknowledged to be positive and oxygen negative. If, as is not altogether impossible, this should ever be altered, it will be necessary to reverse the signs throughout my work.

279. *A third* and last subject on which some preliminary remarks are requisite, is the *word Od.* There is evidently a tolerable probability that the definition of it I have laid down at § 215 includes that which Dr. Faraday a year later introduced to the scientific public as a new material force, under the name of diamagnetism. The British physicist was doubtless unaware of my researches, which have appeared in an English translation in London, or he probably would not have ignored them. Under the definition of the word Od I have

comprehended the final causes of all the phenomena described by me, in so far as they have been found irreconcileable with our previous knowledge of the nature of the magnet and the other dynamics, and are in particular capable of being extended from magnetic bodies to the so-called non-magnetic, to metals, glass, silk, water, salts, and all the rest. Diamagnetism was, indeed, discovered and made known twenty years ago by Seebeck, Munke, Buchner, and Becquerel, which was also unknown to Dr. Faraday; and I have not met in my labors with the transverse position of freely moving non-magnetic bodies in regard to the magnetic current, and for the present a gap remains between the subjects of our labors; at the same time it is in my opinion not impossible that we are both journeying toward the same point, only by different roads. If I am not deceived by appearances, Dr. Faraday has seized one of the many odic threads, one in all cases favorable, and will help onward the question with the force of his fertile talent. This cannot be otherwise than advantageous to the progress of science. Whether magnetism, diamagnetism, and Od, shall one day prove identical, or solid distinctions shall remain between them, is a question of which the solution appears to me to lie at present at a considerable distance. In any case they collectively include totally new qualities of all dead and living matter, and from their generality and all-pervadence throughout the universe, are of the highest physical importance.

Since the interest of the subject will be increased by the clearness and distinctness of the definitions, *i. e.* by the settlement of the extent of their compass and the determination of the boundaries of their component parts, I think it opportune to insert here a condensed sketch of the distinctions which appear to me to hold between the now established allied dynamics, and that for which I have found it necessary to propose the term Od. In this manner, on the one hand, what I regard as the peculiarities of this will appear better exhibited than they have been hitherto, while on the other it will be more clearly seen, whether and what hope exists of bringing the new phenomena enumerated into already known categories, and thus eventually rendering the new word superfluous, or, whether the necessity of establishing and maintaining it is inevitable. The distinctions,—so far, namely, as they have been made known in my earlier, and will be detailed in the present and future publications,—are as follows :—

A.—DISTINCTIONS FROM HEAT.

a. Odic emanations cause feelings of cold and warmth in all the sensitive,—indeed sometimes produce icy cold and burning heat; that is to say, excite sensations *seemingly* like these. But when they are directed upon the thermometer, they have not the slightest influence upon it; even Nobili's thermoscope remains motionless. Neither the cold-giving nor heat-exciting pole of a crystal affects this instrument in the least.

b. Many cases occur in which heat and Od cause diametrically opposite effects. A right hand produces a feeling of cold in the sensitive; but it has always a reverse, heating effect, upon a delicate thermoscope. The rays of the sun produce a feeling of cold in the sensitive; on the contrary, they warm the thermometer. Moonlight is felt distinctly warm; but not indicated perceptibly by the thermoscope. Glowing charcoal, flame of burning bodies of all kinds, radiate a remarkable degree of cold to sensitive nerves: the thermometer, on the contrary, exhibits the effect of heating rays. Chemical combinations give rise to sensations of cold, while liberation of heat is often indicated by the thermoscope.

c. The conductibility of Od by metals surpasses all the limits of the conductibility of heat. A copper wire of considerable length, more than sixty feet, charged odically at one end, delivered variations of odic sensation at the other. A wooden rod did the same, also a glass rod, a silk ribbon, a strip of linen or cotton cloth many yards long; bodies which are far from being capable of conducting heat in this manner.

d. Od penetrates very readily through solid bodies: the sensitive feel a crystal, a man, or a magnet, behind thick walls, in a few seconds, without being aware of their presence: the greatest heat requires many hours before it begins to be even perceptible on the other side. No one feels the sun's rays through a wall, least of all in cooling; but the sensitive distinguish in a moment, inside a building, a wall on which the sun is shining, from another which is in the shade.

e. Concentrated odic rays are felt by the exceedingly sensitive at incredible distances; magnets, poles of crystals, human hands, and trees, at distances of more than a hundred yards; weak rays of heat, proceeding from bodies at the common temperature of the air, are not indicated by any instrument at such distances, and the sensitive perceive the latter just as little.

f. Neither odic heat nor odic cold alter the density or volume of bodies. Even a thermometer may be perfectly charged odically, positively warm or negatively cold, and the index will not alter in the least. Every one knows the effect of heat upon a thermometer.

g. We know already that great distinctions of odic condition exist between the different colors of the luminous spectrum, and we shall become more minutely acquainted with them in this and the succeeding treatises; but when I caused the rays of the sun, moon, or fire, to fall at less than thirty-five degrees upon a ten-fold glass disk, and decomposed the transmitted light into an iris with the prism, the even tolerably sensitive all felt very great differences of temperature between the different colors; thus in places where, as far as we know, no trace of free positive or negative heat can reach.

h. Metallic wires, which appear to the sensitive to glow odically, remain quite at the surrounding temperature to common sensation and the thermoscope.

i. When of two glasses of water, one was left in the shade, the other exposed for a few minutes to the sun's rays, every sensitive person distinguished that which had been subjected to the warm rays as cooler, (§ 105.)

k. Further than this: a porcelain rod heated directly over the fire at one end, as well as a lighted stick of wood, were held in the hand by the other ends; they were felt to become much cooler by the sensitive. I shall detail this more minutely hereafter.

Heat, therefore, is, under given circumstances, a means of odic cooling. *And, therefore, heat must be fundamentally different from Od.*

B.—DISTINCTIONS FROM ELECTRICITY.

Odic phenomena very often occur where electrical phenomena either do not exhibit outward manifestations, or, as far as we know, do not at all exist. Under this head belong sun-light, moon-light, spectra of light transmitted through ten glass plates, crystals, hands, and in part, also, chemical processes, &c.

a. Od is distributed throughout the mass of matter; a hollow metallic sphere is seen to be pervaded with light, internally as well as externally. A glass of water tastes odized throughout its mass; even when poured into another vessel, (§107,) it remains wholly odic; free electricity lies only on the surface of bodies. Od may be transported in the inside of a chamber on to all objects, even to the air, for some time. Dr. Faraday could not accumulate electricity anywhere in a chamber especially prepared for the purpose; it all escaped immediately over the surface of it.

b. When free Od is accumulated in a body, it is retained in it in such a manner that it cannot readily be removed from it; but some time—a quarter of an hour to an hour—is required before it disappears again by contact with other bodies; free electricity is immediately conveyed away by contact from any charged body.

c. Od may be transmitted to unisolated bodies, and accumulated in them to a certain extent. Electricity can be conveyed and condensed only upon isolated, by no means upon unisolated bodies.

d. All bodies which possess merely continuity are almost equally good conductors of Od; the incoherent are only somewhat worse: electricity is only conducted by metals well; by many other bodies, badly; by some, not at all. The transmission of Od in the best conductors, as in metallic wires, goes on slowly—twenty to forty seconds are required for a wire fifty yards long; electricity traverses a million times longer spaces in immeasurably shorter time.

e. Permeability by Od is a character of all bodies; slight distinctions do occur in this respect among different bodies; but they are of little importance. Electricity, on the other hand, is arrested by a great many bodies, which are almost incapable of being penetrated by it, and oppose insuperable obstacles to its course.

f. The action of electricity upon Od takes place at much greater distances, and more strongly, than that of electricity upon electricity. A weak electrical charge from a spark of one-fifth of an inch, produces an active odic current in a metallic wire at a distance of two yards, (§ 169,) where a conductor would no longer produce any observable distribution to the other.

g. The excitement of Od by electricity does not follow instantaneously, but always requires an appreciable time—often thirty seconds or more. This holds both in the production of sensations and of light. A resinous electrophorus is electrical long before the odic flame becomes visible on it. An electrified and a galvanized wire only begin to glow odically after the current has continued to flow for some time through them, or after the Leyden jar discharge has passed some seconds. In a Schweigger's multiplier, the odic light did not appear for ten to fifteen seconds after the deflection of the needle: all manifestations and effects of electricity are instantaneous.

h. The duration of odic phenomena, on the other hand, is incomparably longer than that of electrical transmissions. When a wire rendered odically incandescent in the electrical way is brought out of the current, its luminosity endures for half or a whole minute,—nay, after strong discharge of a Leyden jar, two minutes, and then slowly dies away. In the multiplier, the magnetic needle returns from its divergence back into the meridian, a long time before the coil of wire ceases to emit odic light. Certain flaming odic phenomena in conductors, metal plates, or wire communicators, do not all begin at once, when electrified, at the moment of receiving their maximum electric charge, but after the escape has continued for some time; when the supply ceases, the odic phenomena disappear but gradually and slowly, even from unisolated conductors; their odic condition, however, endures for the sensitive in many cases—for instance, in water, persons, &c.—for an hour.

i. But cases of the reverse kind also occur, in which odic light disappears sooner than the excited electricity; an electrophorus loses in odic luminosity after the rubbing with fur, after a few—perhaps ten—minutes have elapsed; while the electrical charge of the cake lasts for days and weeks. It follows from this, that Od is indeed excited by every electrical action, but then takes its own independent course.

k. Many flaming odic appearances exhibit a constant tendency upwards, and ascend vertically: electricity does not manifest any such tendency, either when in motion or at rest.

l. Appearances of odic light of great size appearing over unisolated electrified metal plates, do not adhere to the metal, but flow over it, like the aurora over the earth: electric currents always remain close upon the metal, wherever it comes in their way. The experiments affording this axiom will be given in the next treatise.

m. Effluences of Od are not exclusively confined to points where these are at hand, but rise out of the sides even of toothed bodies; this is the case even in large crystals. In similar cases, electricity never flows but from the points. In the hydro-electric chain, all the elements diffuse light and sensations of Od: in its electric currents, we are only aware of the internal activity and complete circumscription of the electric circuit when the chain is closed.

n. Odic currents exhibit a remarkable degree of independence of electricity, even when excited by that agent; the isolated metal plates on which the two appear together may be grasped in the hand, or electrified wires may be allowed to lie loosely and touch the ground, without alteration of the streams of odic light, while the electric currents are thereby diverted in totally different directions.

o. Odic flames, from whatsoever bodies they issue, positive or negative, exhibit no tendency to unite or neutralize each other when approximated; when they cross, they go on together; when they are brought into diametrical opposition, they repulse one another. (See *infra*, § 401.) Unlike electricities, neutralize each other with violent attraction.

p. Influence and induction, which produce such remarkable effects in electricity, I have hitherto never been able to detect with certainty in odic phenomena.

q. Electrical tourmaline, like every other crystal, vividly excites the sensitive with its poles; but is not altered by warming, does not become stronger, and the electricity thereby excited is not perceptibly felt.

r. Perhaps the most striking thing is the contrast between the violent effect of the Od upon the excitability of sensitive persons, and the insensibility which the same show to electrical effects, and which is such that even the highly sensitive do not feel them more than the healthy. Hydro-electrical and frictional electrical currents, or the discharge of the Leyden jar, are borne by them as easily as by any other person. Stroking a cat, the approach of a thunderstorm, the tricks played with an isolating stool, are agreeable to many of them.

All this manifests that the gap which separates Od from electricity is very great.

C.—DISTINCTION FROM MAGNETISM.

Od is formed, or manifested vividly, in a number of cases in which magnetism never gives evidence of its presence, or is yet unknown to us; in many chemical processes, in vitality, in crystals, in friction, in the spectra of sun, moon, and candle-light, in polarized light, and in the amorphous material world in general.

a. Development of Od occurs independently and without magnetism in the majority of cases; magnetism never occurs alone, but always associated with Od.

b. In things where magnetism appears to give token of its presence, but as yet is not incontestibly admitted by science to reside, as in the rays of the sun and in moonlight, it is manifested in a so extremely weak degree, that its presence is still highly doubtful; but in these very cases Od appears with a force and a variety of effects which are quite astonishing, and seems capable, in particular instances, of shaking the very foundations of life.

c. The interposition of a mist or clould before the light of the sun or moon at once weakens their effects upon the sensitive very considerably: magnetism is not restrained by anything—least of all by vapor.

d. The transfer of Od may be effected in an exactly homologous manner upon all solid and fluid matter; metals, steel, salts, glass, milk, resin, water, may all, with slight distinctions, be charged with Od: magnetism can only be conveyed to a certain few bodies; nothing, however, is yet known concerning the transferability of diamagnetism.

e. When things of that kind are charged with Od, they react upon the sensitive exactly in the same way as the magnet: but not the least perceptible trace of magnetism resides in them; iron is not attracted, even in the shape of filings, &c.

f. The coercive power over Od has been observed in steel for at most something under an hour; therefore not for much longer than in water, iron, &c. But for magnetism, it is enduring for many years. while it is quite indiscernible in water, iron, &c. Thus magnetism remains in steel; Od cannot persist in it by itself, but disappears.

g. Od is also conductible by substances like resin, glass, wood, silk strings, cotton bands, &c., to the distance of many yards. We know of nothing similar in the magnet.

h. Od may be conducted many yards on a long iron wire, and made perceptible to the sensitive (§ 47, 118); an iron wire about sixteen yards long and one-twelfth of an inch thick, stretched in the *parallels*, and put in contact with the northward pole of a nine-layer horse-shoe magnet, did not exhibit to me, at the other end, any trace of magnetic reaction.

i. The distance of action for Od of the diffusing bodies—such as hands, crystals, or electrified bodies, reaches at least as far as with magnetic bars of the same size; in many cases farther. I have tested and compared both to a distance of 160 feet through the air. We know of nothing at all like this, in regard to distances of effective action of such magnets in exerting magnetic influences.

k. Emanations of Od are found to be subject to a kind of refraction, at least certainly in the cases in which they are accompanied by rays of light. I have already shown, and in a subsequent treatise shall make known many new, certainly very remarkable observations, in which I have found that while a glass prism separates colors, it also produces similar divisions in Od, which, with the rays of light, is subject to refraction by the glass. And since it so completely accompanies light, that in each color of the spectrum appears a different (if I may so express myself) odic color, it is clear that the rays of Od are refracted simultaneously and exactly with the rays of light; consequently, that odic emanations, whatever they consist of, are refrangible by glass, like the rays of light. But this property is wholly wanting in magnetism, which is not arrested by anything, and cannot be deflected, as Haldat has recently shown us convincingly by means of his magnetic measuring instrument. He expressly asserts that emissions of magnetism from bodies are neither refracted nor reflected.—*L'Institut*, May 27, 1846, p. 647.

l. The distribution of Od in bodies is demonstrated, for example, in water, to be effected throughout the mass; magnetized water may be poured from one glass into another, and when drunk is found to be all equally strongly odized up to the last drops; odically luminous metals appear to be translucid, and to glow through and through; odized hollow spheres manifest strong expressions of odic action in their interior: but magnetism, according to Barlow's researches, is restricted exclusively to the surface of bodies.

m. It is found, and will be explained at length hereafter, that Od diffuses around itself spherical zones of alternating opposed polarities, similar to electricity: nothing of this kind has ever been observed in the magnet.

n. Od has no attraction for, or power of supporting iron, not even the smallest filing. The most striking effect of the magnet consists in this very mighty power. But in regard to odic capabilities, crystals and hands of equal size with the magnet are not only equal to it, but frequently surpass it in strength, especially the latter.

o. Suspended odic bodies do not acquire any particular direction from the influence of terrestrial magnetism; but it turns magnetic bodies into the meridian, &c.

p. In the inorganic kingdom, the flames of the Od-poles exhibit no measurable attraction toward each other; poles of magnets, however, and their lines of force, reciprocally, the most powerful. The odic flames, even when they blaze forth side by side from the poles of a horse-shoe magnet, display no attraction; nay, even when the unlike polar flames are directed immediately toward one another, not only are they not attracted when brought close, but are even mutually repelled at the places where they are forced to meet. This is directly contradictory to all we know of magnetism.

q. When the two arms of a horse-shoe magnet are both placed in a horizontal direction, the odic flame also flows straight out from them, but it then ascends upwards in an arc from both poles: no such tendency has ever been perceived in magnetism.

r. A certain amount of odic flame still flows from the magnetic poles of a horse-shoe (vide *infra*, § 458) after the poles have been long rendered magnetically indifferent externally, by the application of the armature: the magnetic efflux is stopped, but the odic persists still, although weakened.

s. Even when two strong unlike magnetic poles are joined, (§ 401, 402, 404, 405,) retain and neutralize each other, an emanation of odic flames nevertheless persists uninterruptedly, although rendered weaker.

t. Magnets brought into the electrical atmosphere of the conductor may have their odic polarity reversed, while the magnetic remains quite unaltered. Electricity thus exerts a power over the former, which it in no case possesses over the latter. (Vide *infra*, § 373, 436.)

u. The appearance of Od and that of magnetism never occur simultaneously in their production. When a galvanic current acts upon a multiplier or a rotating apparatus, the reaction on the magnetic bar is instantaneous: the odic luminosity and the effects upon the sense of feeling do not appear until after the lapse of several seconds, and the more slowly and later, the longer the conducting wires are. The same is the case with the cessation; the magnetic reaction ceases immediately on the interruption of the galvanic current, but the odic effects last a good while longer.

v. When a crystal, a finger, or a rod dipping in any chemically-acting substances, is placed within a wire-coil, no induction is caused, even when these bodies are much larger and more odically potent, much stronger in emanation of light and excitation of sensations, than a magnetic bar; this last may be ten times smaller and a hundred times odically weaker, and yet will instantaneously induce a current in the wire coil. (Vide § 40.)

w. When a magnetic bar is held in the hand in such a manner that the magnetic pole of the same name as the odic polarity of the hand is outwards, its odic flames and odic force increase; but it does not support a grain more iron on that account. Exactly the same, *mutatis mutandis*, is caused in magnetic bars by the poles of crystals. The magnetic bar gains Od from the odic hand or crystal pole, but it does not receive the least accession of magnetism. (Vide *infra*, § 442 and 444.)

x. The above-mentioned influence may go so far that the odic force of the bar may be even reversed, while the magnetic polarity remains altogether unaffected. When a weak magnetic bar is grasped by the southward pole in the left hand, the projecting northward pole not only loses its blue negative flame, but a red positive one immediately begins to issue from it, while its negative magnetic character remains unaltered. (Vide *infra*, § 446.)

y. In the course of these treatises, we shall become acquainted with remarkable cases where the odic flames of magnets are extinguished by the approximation of organized living beings; their magnetic force is not in the least changed by this. (Vide *infra*, § 448.)

z. The moon also affords a beautiful proof of the distinction between magnetism and Od. I have shown in an earlier treatise, (§ 119,) that the moon acts od-positively upon all the sensitive. On the other hand, M. Kreil, the Prague astronomer, distinguished for his scientific discoveries, informs us in the first volume of his Astronomico-meteorological Year-book, p. 104, that the moon exerts an attraction on the southward pole of the magnetic needle, consequently must have, on the side turned towards us, the magnetism of the south pole of the earth, and this, according to my rule of deduction, is negative magnetism. This looks like a contradiction when superficially considered, but is solved by more accurate examination. For the magnetic effect which the moon exerts on the needle is so weak, that it can only be detected by observations like those of a physicist as accurate as M. Kreil; but it is not nearly strong enough to react perceptibly on moderately and healthy sensitive persons. Now all the sensitive feel the moon od-positive, and this very vividly. It is the rays of light of the moon that produce the active effects we meet with. This is proved most clearly by the circumstance, that the effects of the moon upon the sensitive may be in great part removed by keeping away the direct radiation or the reflection of the rays, by good window shutters; magnetic influence, which penetrates everything, could not be turned away by intercepting the rays. Thus, in spite of the fact that the half of the moon turned towards us has proved to be negatively magnetic, it nevertheless diffuses abundance of positive Od to the earth.

a a. Of diamagnetism we at present know only the repulsions, which, from Haldat's observations, may in the end range themselves with the true magnetic phenomena.

b b. But the distinction between Od and magnetism comes to light most strikingly in the following experiment:—Let an iron rod of about twenty inches long be fixed in a wooden holder of any kind, which shall be attached to its axis. When this is so directed that it lies horizontally in the magnetic meridian, every sensitive person feels its northward end cool, its southward end tepidly warm. If the northward end be declined till it be placed in the magnetic dip, *i. e.*, if the rod be turned till its temporary northward end make an angle of about 65° with the horizon, it then will attain its maximum magnetic condition; the coolness of its northward pole should in like manner increase to its greatest height, the southward pole also in warmth. But, instead of this, we find exactly the opposite. The magnetic northward pole now becomes odically warm, the magnetically southward pole odically cold. Od and magnetism, which otherwise proceed side by side in a certain parallelism of manifestations, here meet diametrically opposed, *the negatively magnetic northward pole is od-positive, the positively magnetic southward pole is od-negative—under the circumstances here introduced; the two follow directly contrary paths.*

c c. We shall meet below with cases where superimposed layers of steel of like magnetism are reversed one above the other; so that, while all possess one kind of magnetism, there occurs an alternation of positive and negative odic layers. This may be strengthened by approximation of crystals and hands, but is removed by that of magnet poles. (Vide §§ 340 and 344.)

d d. We shall actually meet further on with an experiment in which positive magnetism and emanations of negative odic light occurred simultaneously in a particular element of the arms of a horse-shoe while passing over another magnet, (§ 433.)

Therefore, at present the identity of Od and magnetism is altogether out of the question.

Consequently, the distinctions which exist between heat, electricity, magnetism, and Od, have not merely remained undiminished by the ulterior researches continued since § 276, but have rather made themselves more strongly manifest; and they will become still more so in the following treatises. They are expressed so definitely and clearly in many points, that the necessity of a special terminology appears more inevitable than ever. *Under the definition of the word Od, I include all the physical phenomena presenting themselves in these researches, which cannot be brought under the definition of the dynamics hitherto acknowledged, together with the* VIS OCCULTA, *on which they depend.* Whether, and to what extent, they will, in the course of time, be distributed and transferred into the provinces of the latter, remain questions for future research, and are deferred till the acquirement of a deeper insight into the essence of these things.

Every one is almost convinced that electricity and magnetism are of one nature; no one doubts that here essential force of one kind acts on the one side in a half-free, on the other, half-confined condition; we are all in hourly expectation of the approaching discovery, through which their identity shall be demonstrated, and the two be made capable of comprehension under a common definition: yet we shall never be able to dispense with either of these words. In the same way it will happen with the word Od, or any other that it may be agreed to receive in its place; it will be necessary, in order to comprehend a certain complication of phenomena, which cannot be otherwise registered than as a special group.

EIGHTH TREATISE.

LUMINOUS PHENOMENA.

The Odic Luminous Phenomena on the Magnet.

280. I COMMENCED the present series of treatises with the most striking of the luminous phenomena—those of the magnet; those of crystals followed; then I made known those of certain human organs, such as the hands; and thus I proceeded onward to those of the heavenly bodies, heat, friction, light, electricity, of chemism, and finally of matter in general. In all these cases, however, I have only made mention of them *generally*, in so far as I endeavored to obtain signs of the existence and activity of Od, and could establish these through the evidence of the existence of the luminous phenomena. I have confined myself to this in all places, and reserved a discussion of the latter *in particular* for a special treatise. Such will be the object of this, the eighth, and the succeeding essays, and I thus perform the promise made in § 55 and § 93.

281. Hitherto, in the many cases mentioned, I have only reported the sensuous perceptions on which the detection of the odic light depends, as derived from the statements of the highly sensitive; the following pages will show, however, that it is by no means only these who detect it, but that the odic light presents itself in innumerable cases so distinctly and prominently, that not merely also the slightly sensitive, but, *what now becomes of the greatest importance, a large number of* PERFECTLY HEALTHY PERSONS, *are capable of seeing it.*

282. I shall now in the first place give the physical fact, the existence of the odic light, new and more extensive confirmation by a great addition of observed cases; then examine these more closely in the different forms of their occurrence; compare their relations both with each other and with allied natural phenomena; deduce certain new laws for Od from them; and from all this seek to make out some fixed points for establishing its place in the domain of physics.

HISTORICAL ESTABLISHMENT OF THE FACT OF ODIC LIGHT ON MAGNETS IN GENERAL.

283. In the earlier treatises it was shown that the odic light was perceived by all the highly sensitive, without exception, who were included within the sphere of my investigations, and thus its actual existence established and placed beyond reasonable doubt, by a series of testimonies agreeing in all essential particulars. It was further demonstrated that the different degrees of strength in which different persons saw it, depended on the varying conditions of disease of the observers, and finally that in one and the same observer, different stages of diseased condition caused a different degree of sensuous receptivity, and thereby a different appreciation of the impression of the light upon the senses. This must be clearly understood. Miss Nowotny, when nearly well, no longer saw any light, even on the strongest magnet (§ 3). Some days earlier, when her recovery was not so far advanced, she still saw momentary flashes, disappearing immediately, when the armature was removed from a magnet in the dark. Two days before this, she had seen a luminous thread along the edges of the steel, and a week previously, a beautiful shining flame at each pole of the open magnet, the ray-like emanations of which were from three quarters of an inch to one inch and a quarter long. Miss Sturmann (§ 4) saw the flames of the same magnet about four inches in length, thus more than three times as long. Miss Reichel drew me these, from her observations, of the length of the arm of the horse-shoe, that is, twelve inches long. Miss Maix (§ 6), in her usual condition, saw them only a hand's breadth, but whenever she was seized with an attack of spasms, the same magnet appeared to her wholly enveloped in fire, and the flame in places several spans long. Miss Reichel (§ 7) saw the magnet in moderate obscurity, not merely emit flames from the poles as long as the arms of the horse-shoe, but also a delicate light spread all over the magnet, and this latter even while the armature remained applied. But Miss Atzmannsdorfer (§ 13) told me that the flame of my large nine-layered magnet attained almost the size of a man in her eyes when it was very dark, so that she frequently saw herself wholly enveloped in it, as if she were being burnt. She saw both this and smaller magnets enveloped between and around the arms by delicate down-like flame; the poles, each flaming, especially at its four corners, in blue and red, yellow and green intermingled, and each layer of the compound magnet possessing its own lateral flames (like § 9). Bar magnets always flamed more strongly at the northward pole than at the southward in this case.

284. These observations all belong to the year 1844. I collected a much greater number of them in the years 1845, 1846, and 1847, during which I devoted myself with unceasing efforts to the pursuit of this attractive subject. Those of the results simply serving to the further confirmation and establishment of the fact of the existence of the odic light over the magnet, I subjoin here seriatim. I remark, however, expressly, that this is done chiefly for those readers whom the previously reported observations do not suffice to convince, and who consider a greater number of testimonies necessary for the establishment of the physical phenomena of the diffusion of light from the magnet; all those, on the contrary, who are satisfied by what has already been brought forward, and who consider the accuracy of my mode of investigation sufficient, can, without any great loss, pass over these, and turn from here immediately to § 334, where, leaving behind all the concrete cases and specialities, they will arrive immediately at the conclusions deduced from them.

I follow the order of rising from the weakest powers of vision to the strongest, proceeding from the healthy sensitive to the sickly, and ending with the permanently diseased, highly sensitive persons.

a. Healthy Sensitives.

285. Among these I met with a few who possessed the odic feeling very strongly marked, but were unable to recognise the magnetic light; others who saw it weakly; lastly, some who saw it with greater facility, and with a clearness and distinctness which excelled not only that of many invalids, *but even of actual somnambulists.*

286. Dr. Friedrich, from Munich, a young, healthy physician, from whom I learnt that he was sometimes subject to walking in his sleep, had the kindness to allow me a trial, and to place himself in my own dark chamber prepared for these researches. I found him distinctly sensitive, but in a weak degree; he saw other objects emit light, but never magnets.

287. M. Edward Hütter, bookseller, grandson of Anton Doll, in Vienna, a fine, young, and perfectly healthy man, was excitable in many ways to the odic sensations, but had no power of seeing the magnetic luminosity beyond a weak and uncertain appearance on a small, strong, horse-shoe magnet, in the dark.

288. Maximilian Krüger, a boy of twelve years, in the Orphan Asylum at Vienna, sensitive to a considerable degree to the impressions of the odic feeling, was unable to detect any impression of magnetic light in the dark.

289. Mr. Carl Rössner, Imperial Counsellor and Professor of Architecture in the Academy of the Plastic Arts, at Vienna, forty-two

years of age, remarkably sensitive to all impressions on the feeling that can be excited by odic influence, could not detect a trace of luminous appearances during three hours which he was kind enough to devote to me in my darkened chamber.

I met with the like frequently, especially in men; most remarkably in Dr. Diesing, Keeper of the Imperial Museum of Natural History in Vienna. Although very highly sensitive to all impressions on the feeling, he was totally insensible to luminous phenomena of all kinds in the dark, where he remained for four hours.

We thus have here five decided sensitives in whom the light which issues from the magnet could not be brought to evidence. This warrants our concluding that the sensitiveness is not always necessarily connected with the power of seeing and perceiving the magnetic light. These cases are undoubtedly the rarer.

290. Mention has already been made frequently of Mr. C. Schuh, in speaking of sensitive perceptions of feeling; he stands on the outermost limit in the luminous phenomena; he does not see the magnet flames, but he distinctly recognises the shape of horse-shoes and magnets in complete darkness, and thus sees weakly the emanations of light from the magnetic metal itself. This is what I have called the *odic incandescence*, and constitutes the first degree of perception of light.

291. Mr. Hubert Von Rainer, of Klagenfurt, twenty-four years old, barrister, a man of exuberant health and strength, has never been ill, and knows neither headache nor disorder of the stomach. His sensitiveness in the sphere of feeling is strongly marked, but he only detected the magnetic light with certainty when I pulled off the armature from the horse-shoe, whereupon he saw a flash at the moment of separation.

292. Dr. Ragsky, Professor of Chemistry in the Joseph Medico-Chirurgical Academy at Vienna, a very healthy, unusually tall and powerful man, thirty-two years old, exhibited every sensitive excitability. He did not see a bar magnet in the dark, but he saw horse-shoes, if they were single and strong, so far towards the poles, that he was able to distinguish the shape of the steel. With intermissions, he detected appearances of blue light at the northward pole, at the southward pole nothing.

293. *a.* Dr. Huss, Professor in the Hospital at Stockholm, Physician to the King of Sweden, saw only the more powerful phenomena of odic light in the dark chamber, but not common magnets. Yet when I placed before him a strong electro-magnet, with a Smee's battery of some 400 square inches of zinc and silver surface, he perceived at one of the two poles, the negative, the formation of a pale

light, which developed abundance of smoke, ascending upwards like a cloud.

293. *b.* Hermine Fenzl, eight years of age, the daughter of Dr. Ed. Fenzl, Chief of the Botanical Department of the Imperial Museum of Natural History at Vienna, a child of slender make and active mind, healthy and gay, showed strongly all the reactions of sensitiveness to feeling; but she did not perceive the luminous phenomena in the dark so well. She saw three large and one small horse-shoe magnets emit grey light, the last most brightly; she described the northward pole as more strongly luminous than the southward. Of bars, she saw only some three-fourths of an inch long, illuminated, others eight inches long she did not perceive. She could not detect flames or smoke. She did not see brightness of any kind on larger magnets.

294. Baroness Isabella Von Tessedik, the young widow of Mr. Franz Von Tessedik, of Pesth, a mother, of calm temperament, a lady of remarkably intellectual cultivation, saw a magnetic rod twenty-eight inches long, and all horse-shoe magnets with the steel weakly luminous, so that she could distinguish their figures, glowing odically, in the obscurity of the dark chamber. She saw a one-layered, a three-layered, and a nine-layered horse-shoe, furnished with a luminous cloud four to eight inches long on each pole. She detected the same on a horse-shoe electro-magnet. On this, however, and some other horse-shoe magnets, she could only perceive the luminous vapor on the northward pole. She saw the magnetic light more brightly when I pulled the armature off quickly; this caused a momentary flash, like lightning.

295. Mr. Constantine Delhez, forty years old, a French philologist, at present residing in Vienna, healthy but distinctly sensitive, saw, after a sojourn of an hour and a half in the dark chamber, magnetic rods glowing, and a one, a three, and a five-fold horse-shoe, emit lights from one-third of an inch to four inches long from the open poles; from a nine-fold horse-shoe they rose more than twenty inches; from an electro-magnet they attained almost forty inches; and both produced illuminated spots on the ceiling more than forty inches in diameter. Both the appearances of odic incandescence upon the steel magnets, and the flame-like emanations flowing from the poles, always seemed to him somewhat vaporous, as is described by all the sensitive of inferior degrees of excitability.

296. Our revered Consistorial Counsellor and Superintendent of the Evangelical Communion in Vienna, Mr. Ernst Pauer, to whose congregation I and my family belong, of tall and imposing form, but of delicate make, fifty-four years of age, whose sensitiveness is espe-

cially strongly marked in the effects on the feeling, saw all magnets luminous all over the metal: on some of the smaller, the flashes when I removed the armature, and emanations of odic light from the poles of small bars, as well as particular horse-shoes; in some only from the northward pole, in a five-fold horse-shoe from both poles, stronger at the negative and weaker at the positive. He saw an electro-magnet furnished with pale lights over both poles, two inches high and of the same breadth.

297. Baroness Pauline von Natorp, of Vienna, mother of two children, young and intelligent, blonde, saw the flashing lights of small horse-shoes when the armatures were taken off, and the permanent light on the northward arm. On larger magnets, she sometimes saw the light only of one, always the northward, arm, sometimes of both, as a luminous cloud almost four inches long. On larger magnets of relatively weaker intensity she saw only a weakly illuminated delicate vapor over the poles.

298. Mr. Demeter Tirka, a Greek merchant in Vienna, forty years old, distinguished for his love of objects of plastic art, of powerful build, and, with the exception of occasional headaches, healthy all his life, saw light flash from a small and a large horse-shoe when I pulled off the armatures, each time over the northward pole; he saw a permanent light over the same pole of a three-fold horse-shoe, but nothing on the southward pole. He saw no distinct flaming on a heavy nine fold horse-shoe, but he perceived all objects in the immediate vicinity to be illuminated by it.

299. Mrs. Sylvia von Varady, wife of the imperial counsellor Mr. von Varady, a young, blooming lady, lively, healthy, of Italian family, saw all rods and horse-shoes dully luminous in the dark. She saw a one-fold horse-shoe emit vaporous lights two inches long, and the nine-fold horse-shoe five feet high over the poles, when the armature was removed. Strongly magnetic rods of eight inches in length bore lights on their poles three-quarters of an inch long.

300. Mr. Theodore Kotschy, evangelical minister, the botanist, the renowned and vigorous traveller through Africa and Asia, of whom mention has been made already in §§ 80, 191, 222, 232, saw flashing flames, which soon disappeared, on the northward pole of simple horse-shoes when the armature was pulled off. On three-fold ones he saw thin, vaporous lights blaze continuously, one to two inches high; when I applied the armature and pulled it off again, they flashed up brighter for a moment, but sank again directly to their previous permanent state. A nine-fold horse-shoe he did not see at first, but soon recognised an extremely thin, widely diffused luminosity over the open arms, playing over them, more than six-

teen inches broad and almost forty high. He did not find it like a flame, but like an extremely delicate glimmering of light in the general darkness. He saw a small pocket horse-shoe more brightly and distinctly endowed with light than the nine-fold; its magnetism had greater intensity. He saw light only on the northward pole of a three-fold horse-shoe.

301. Miss Ernestine Anschütz, daughter of our celebrated court actor Mr. Anschütz, a young lady of quiet and reserved disposition, at present perfectly healthy, but in her earlier years occasionally suffering from spasms and headache, saw the steel substance of all magnets weakly luminous. On the poles of two magnetic needles, each four inches long, she saw flames on the one side yellowish, on the other bluish, but mere incandescence along their steel substance, more weak in the middle, stronger towards each pole. Of the poles of a pocket horse-shoe she saw the northward pole furnished with a delicate flame more than one inch long, on the southward pole nothing. A five-fold horse-shoe she saw with flames of a finger's length on both poles, that on the positive side yellowish, that on the negative bluish. She also perceived a nine-fold horse-shoe to be furnished at both poles with delicate emanations of light, which were from twelve to sixteen inches long, one a little shorter and yellowish, the other larger, and rather bluish or greyish.

302. Mrs. Josephine Fenzl, wife of our botanist, known throughout Europe by his literary labors, the already named Dr. Fenzl, a young mother of several children, healthy and blooming, saw a magnetic rod twenty-four inches long glowing odically in the dark chamber, and emitting flames at both ends. She described a one-fold, a three-fold, a five-fold, and a nine-fold horse-shoe as luminous and giving out luminous vapor in different degrees. Some months later, she saw a nine-fold horse-shoe flame twenty inches high, and luminous smoke rise half the height of the chamber above it. At the same time she described smaller and larger rods as odically incandescent, and furnished with polar flames, those of the northward pole longer, duller, and bluish, those of the southward pole shorter, brighter, and yellowish-red.

303. Mr. Franz Fernolendt, from Transylvania, proprietor of a chemical manufactory in Vienna, residing at 825, in the Kumpfgasse, 54 years old, perceived the magnet less by its odic incandescence than by its polar flames. He saw very few of them glowing brightly, only the small rods and a pocket horse-shoe; but on the other hand, he saw a bright cloud over all, which appeared to him as a light glare sweeping over the poles. Sometimes he saw a flame flash up when I pulled off the armature. He perceived the streaming brightness

over a one-fold horse-shoe, a three-fold and a five-fold, but always either exclusively upon the north pole, or else more distinctly than upon the south, and frequently in the form of a grey cloud. On a large nine-fold horse-shoe he perceived the issuing light twenty inches high; but when I acted upon its emanations by the approximation of a positive electrical atmosphere, he saw a mass of odic light rise up gradually over it, ascending with a thickness equalling a man's body, up to the ceiling of the room.

304. Mr. W. Hochstetter, son of Professor Hochstetter, of Esslingen, in Wirtemburg, (the distinguished botanist presiding over the "Unio Intineraria,") twenty-one years of age, engaged in the study of horticulture in the Imperial Gardens at Schönbrunn, of very florid aspect, moving about all day in the open air, saw all magnets, down to the smallest bar, odically incandescent in the darkened chamber. He saw the flames issue from the poles, not like flames, but as a luminous halo, only from rather less to rather more than an inch long from the smaller, and increasing with their size, till, on the nine-fold horse-shoe, they attained a length of twenty inches. These lights he saw larger and brighter on all the northward poles of bars and horse-shoes; at the southward, sometimes very small and dull, and scarcely visible; but always accompanied by abundance of smoke.

305. Mr. Nicholas Rabe, about forty years of age, a higher official in the Imperial Magazine of Mining Products at Vienna, who, throughout his life, has been perfectly healthy, vigorous, and of lively, cheerful, and warm temperament, discerned the metallic substance of all magnets laid before him in the dark, by a delicate luminosity, more especially the horse-shoes, while their armatures remained applied. From a magnet bar, he saw lights issue from both poles; he saw a magnetic rod about five feet long furnished at the northward pole with a flame twenty inches long, the southward with one of twelve; the extremities of these passing into a luminous vapor, which was stronger and thicker at the positive pole than at the negative. He saw all horse-shoes flame at both poles, after the removal of the armature, more strongly or weakly according to the intensity of their magnetism. The ends of the flames always lost themselves above in a luminous, smoke-like vapor, which ascended slowly upwards.

306. Johann Klaiber, cabinet-maker, whose name has already been mentioned in the earlier treatises (§§ 50, 191) on the odic sensations, distinguished a magnet laid before him by a brightness extending through the whole mass of the steel. A long horse-shoe, too weakly magnetic to support its own weight, appeared to him to possess a scarcely perceptible luminosity, hardly connected with the northward pole, but discernible about four inches above, as if waving gently

over it. Other witnesses have perceived the like, of which I shall give the details hereafter. A three-fold horse-shoe seemed to him to have a pale bluish flame on the northward pole, of variable size, sometimes about an inch, sometimes full four inches long, changing with the receptivity of the observer. The end was always lost in luminous odic vapor, intermingled with isolated brilliant little sparks. The southward pole he saw sometimes wholly without flames; sometimes with but a weak light, alternately appearing and vanishing. A nine-fold horse-shoe did not appear at all luminous to him at the poles, at the first moment, when quite close to it; but when he drew back a step, he discerned that it glowed odically, and that luminous appearances blazed up over it to the distance of an arm's length, issuing from both poles, coming to a point above, mostly as a blue flame, passing into a broad slightly luminous vapor, which rolled upward in the air, carrying with it many isolated sparks, which were soon extinguished.

307. Mrs. Eleanore von Peichich-Zimanyi, the young widow of the Imperial Secretary of State, Mr. von Peichich, of Hungarian family, really healthy, but with rather weak nerves and excitable, detected the odic incandescence of all magnets: bars eight inches long emitted vaporous light two inches in length; horse-shoes of a single layer displayed to her emanations of light as long as one's hand from the northward pole; half as long from the southward. A nine-fold horse-shoe emitted light, more than forty inches long, from the northward pole. In all cases the northward pole seemed to her to have stronger flames than the southward, usually double the size. The removal of the armature produced a momentarily stronger flash of the light. The poles of all horse-shoes appeared to her to have stronger light than those of bars.

308. Stephan Kollar, son of the keeper of the Imperial Museum of Natural History; Mr. F. Kollar, fourteen years old, slender, lively, healthy, often restless in the night, and a talker in his sleep, saw all bar magnets, horse-shoes, and electro-magnets odically incandescent, and furnished with flaming lights, stronger at the northward pole,—the weakest about three quarters of an inch long, the large and strong twenty inches and more. These terminated in clouds of smoky vapor ascending upwards. The investigations were made in the presence of his father.

309. Miss Sophie Pauer, daughter of the Superintendent above mentioned, who was kind enough to be present at the experiments, is very young, and in perfect health, tall and slender, and of sensitive temperament. She was good enough to devote herself to the repetition of these researches several times, at intervals of a few

months. When, after allowing sufficient time for her eyes to become accustomed to the darkness, I placed before her a row of magnets, the horse-shoes among them being still closed by their armatures, she saw them in their natural form and luminous; *i. e.*, odically incandescent, and she expressed pleasure at the peculiarly delicate beauty of the appearance. As I removed the armatures one after another, she saw the odic flames blaze up over the poles, and always stronger, larger and brighter at the northward than at the southward poles. The flames always became brighter when I pulled off the armature, and then returned back to their constant magnitude. They appeared to her one and a quarter, two and a half, four, and eight inches long, according to the different strength of the bar and horse-shoe magnets. She saw the nine-fold horse-shoe with flames twenty inches high, and above these a delicate vaporous column rising up to the ceiling of the room, the northward pole having a blue, the southward a reddish-yellow flame. She found a pocket horse-shoe glow most intensely when it lay upon her extended hand, its light being strengthened by her own odic force.

310. Dr. Endlicher, Professor of Botany, Director of the Botanical Garden of Vienna, forty-three years of age, so well known and celebrated throughout Europe as a naturalist, that I need say no more of him or speak of his fitness for physiological researches, favored me with his presence for some hours in my darkened chamber. He saw, besides the light which parts of the human body, organs of plants, crystals, and amorphous substances, gave out abundantly and distinctly, whitish luminosity of magnetic bars eight inches long, and elongated flames issuing from both the poles: he also saw one-fold, three-fold, and five-fold horse-shoes surrounded by a halo of light as long as they remained closed, and when opened emitting vaporous flames two to four inches long from both poles; while the nine-fold horse-shoe, turned upwards, sent out streams of light which were almost forty inches high, and produced a light spot upon the ceiling of the room. He saw the same in a larger and stronger degree from the poles of a strong electro-magnet; viz., forty inches high, brilliantly colored, stronger from the northward than the southward pole, and producing a bright circle of greater extent upon the ceiling.

311. Mr. Gustav Anschütz, painter, of Vienna, residing in his own house, No. 268, Ferdinandsgasse, in the suburb of Wieden, was the first sensitive in whom I discovered that even perfectly healthy persons were capable of seeing the odic light. This was a great and unexpected discovery for my researches, and for the position of the subject in the domain of physics, attacked by such a variety of ad-

versaries. From this moment the chain was loosened which had hitherto bound me to the diseased; no one could now obstinately regard sensitiveness altogether as a natural phenomenon dependent either mediately or immediately upon somnambulism, whatever I might say to the contrary; it overcame the often-heard, untenable objection, that no faith was to be placed in the statements of diseased persons,—as if every one became ripe for the mad-house directly sickness attacked him! Now, Mr. Anschütz entered the circle, a healthy, vigorous man, of thirty-five years, thoroughly inured by a thousand hard marches and dangers during his former military life, who had never suffered from real illness, of moderate stature, rather fair than dark, very muscular, a distinguished gymnasiast, of lively and excitable, but sensitive and sympathetic temperament, and completely an artist by nature. I found every form of well-marked sensitiveness in him; and he was the point of departure from which, in my odic researches, leaving the diseased, I turned toward the healthy sensitive, whom I then met with in such abundance in all directions, that I was enabled to dispense altogether with the sick, and to solve the physical questions of sensitiveness with the healthy alone. After remaining about an hour in perfect darkness, Mr. Anschütz saw all the odic luminous phenomena as clearly and accurately as any diseased sensitive. I shall return to this in all the categories, but here only make use of what he told me respecting the magnetic light. He saw all steel magnets in a whitish-grey odic incandescence in the blackness of the general obscurity, especially at the edges, and more distinctly towards the poles than toward the axes of the magnets.—He found on two magnetic needles four inches long, luminous emanations at the poles. He saw all horse-shoes emit light from the poles after the removal of the armatures, sometimes from one alone, the northward—sometimes from both; in which case the southward pole always appeared weaker, smaller, and duller,—sometimes with only little luminous specks seeming to lie upon the very poles, visible at one time, and then vanishing again from his eyes. Magnets which I had brought to his residence and left with him for some time for observation, all appeared luminous to him in less complete darkness than was afforded by my darkened chamber. He saw both a pocket horse-shoe and a three-fold magnet never flame but at one pole,—the flame not constant, but appearing to increase strongly every now and then, and disappearing again: after a half or whole minute's intermittence, it again emerged from the darkness, became large, then small again, sometimes concentrated, at others resembling a large, light cloud. The cause of these variations is wholly subjective, and I shall explain them further on. The nine-fold horse-shoe appeared to him only to have a luminous cloud on its northward pole, in the imperfect darkness. But this does not exhaust the interest that attaches the reader and myself to Mr. Anschütz. He is a painter. In him was the right man found, not merely to relate and describe what he saw, but capable of what no one else was,—namely, of reproducing for us in forms and colors what he saw, and placing before our eyes a picture of that which, from our want of vision, we longed in vain to see ourselves. One morning that I visited him, he surprised me with a black picture: at the first moment I saw nothing in it, in the light in which he exhibited it to me; but when he turned it, a cloudy figure rose delicately and phantom-like from the darkness: it was the face of his beautiful wife, as it had appeared to him in its odic light in deep darkness. It was surrounded by crystals, magnets, flowers, and bands, and I saw before me a picture of natural phenomena such as human eyes had never met before. The delight which I felt with this I try to convey to the reader by giving a representation of this remarkable picture in the Plate opposite.—Unfortunately, no art of the printer is capable of giving more than an approximation to such an extremely delicate object. It will be seen by it that Mr. Anschütz's illustrations agree in all points with the accounts of the diseased sensitives, as laid down in my previous treatises, and that his drawings, founded on the one hand on actual inspection, and on the other on his knowledge of drawing, do not deviate from them in any essential points. I have often been compelled to meet the objection, that my conclusions are inadmissible, because the statements of the sick are not to be depended on.* While, now, such objections against patients whose minds are perfectly clear, and who regularly perform their daily duties, are groundless, and easy to be rebutted, every pretext against the reception of my observations, is now for ever removed through Mr. Anschütz. In the same way, the drawings of the luminous phenomena, which I gave in the earlier treatises, have been many times attacked because they were founded in part upon descriptions, more than upon actual sight; and the wish has been expressed, that they could be made by an immediate observer, himself, a draughtsman. Now, then, I introduce an observer and draughtsman, armed *lega artis*, to the physical world, in Mr. Anschütz, whose sensitiveness will doubtless endure as long as his life, and whose ready kindness will afford every stranger repetitions and confirmations of all that is here said.

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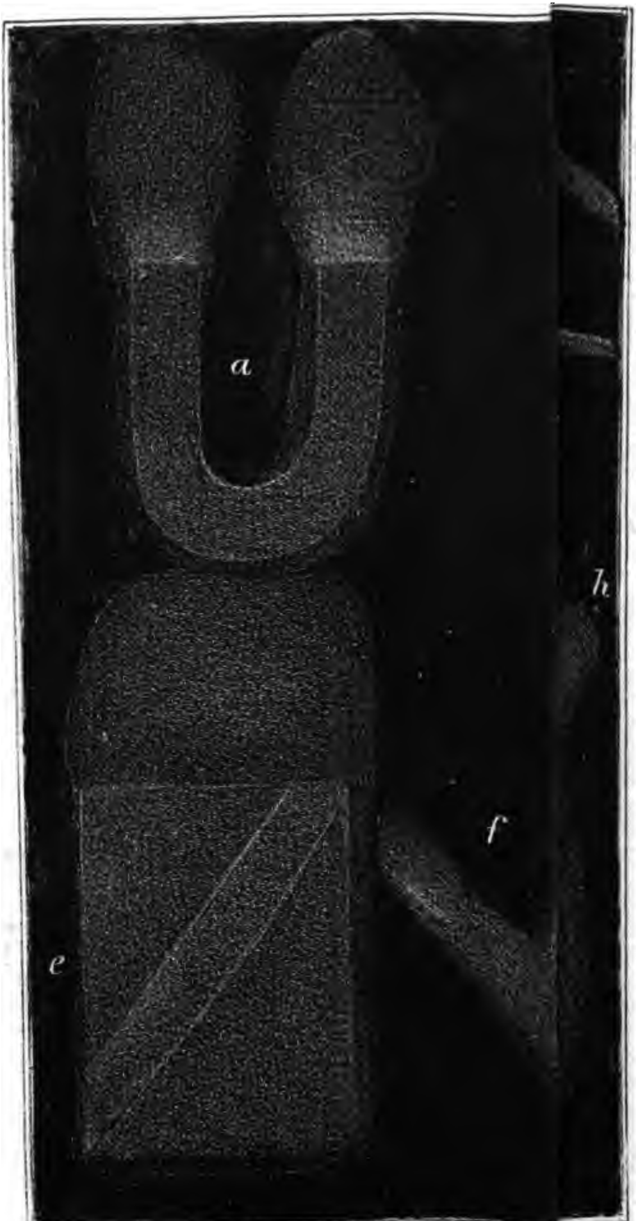
* This clumsy objection may often be met with among unreasoning skeptics. The brains of some persons are, in various respects analogous to those of idiots, inasmuch as they are deficient, wholly or in part, of certain portions of the organization necessary to the completeness of this very important viscus. With such individuals, where they are discovered, it is useless to spend time in endeavors to clear up points of newly discovered facts. They revert with tenacity to their own conceits, and are for the most part so much like the fool of Shakspeare's thought, that they are better left to their own kind of wisdom, where ignorance is bliss. In a case of a lady willed to sleep at a distance of two miles, there occurred during her state of somnambulism some facts corroborative of the impressions made on Mr. Anschütz, and reproduced by the power of his art upon the minds of others. The patient saw her sister wherever she moved about the house, with a face emitting the odic light, more especially from the eyes, mouth and forehead. A lady residing at the Mesmeric Infirmary, is of the class of the Baron von Reichenbach's healthy sensitives. She has afforded, in her waking state, striking corroborations of the accuracy of Mr. Anschütz in the delineations of the facts he witnessed, as well as of the truth of the statements of several of the Baron's other cases.

312. Baroness Maria von Augustin, wife of Baron von Augustin, Major in the Imperial Army of Austria, a lady of distinguished scientific culture, very healthy, soon discerned in the dark room all magnets, bars, and horse-shoes in a luminous odic glow, at first only as a luminous cloud, afterwards appearing with the true outlines of the objects. On bars eight inches long she saw light streaming out as a continuation at the ends of both poles; on one, three, and five-fold horse-shoes, after the removal of the armatures, fine vaporous emanations of light, four to eight inches long, larger and stronger at the north than at the south poles. On a nine-fold, and still more on a strong electro-magnet, she saw flame-like appearances of light as high as a man, rising up, giving colors, sparks and smoke, ascending to the ceiling, and diffusing a light over it.

313. Wilhelmine Glaser, 24 years of age, daughter of an innkeeper at Bächtitz in Moravia, at present a chambermaid in Vienna, somewhat short, but stoutly made, always healthy and strong, who had been uninterruptedly engaged in laborious service for six years, saw all odically luminous objects after an hour's sojourn in the darkened chamber: for instance, she saw all magnets in a white glow, and the poles with flames blue on the northward side, and reddish-yellow and brownish-red on the southward. She found the flames on a round magnetic rod twenty inches long, four inches in length at the former, two inches at the latter. The nine-layered horse-shoe, standing upright, gave vertically ascending flames, twenty inches long, pale yellow and blue at the northward pole; and ten inches long, yellowish-red, at the southward, both terminating in smoke streaming up to a long distance. She beheld flames forty inches high upon an electro-magnet.

314. Mr. Sebastian Zinkel, an old man in his 77th year, who had been all his life healthy and vigorous, formerly an innkeeper, at present living retired in his own house, No. 87, Nussdorf, near Vienna,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[illegible] from the magnets, crystals, &c., [illegible] the sense of sight. As he enjoyed [illegible] himself with them for many hours in the dark, and gave [illegible] accounts of what he saw. He saw a nine-fold horseshoe [illegible], both when closed by the armature and open; [illegible] the light was stronger at the poles than at the bend; when [illegible]. He saw luminous, flame-like, continuous [illegible] of light issue from the poles of the open magnet [illegible]. From the southward pole, dull and yellowish red, about [illegible]; from the northward pole, four inches long, bright [illegible] ended in a smoky, vaporous [illegible], which [illegible] few times the length, and then was lost. [illegible] was then enveloped in a luminous cloud as thick [illegible] stronger when the armature was removed, weaker when [illegible] the armature partook of the [illegible] and appeared red where it was in contact [illegible] and then grey where it touched the south [illegible] of 72 years saw the odic light [illegible] at the period of the development [illegible] woman.

[illegible] practising in Vienna [illegible] was an invaluable [illegible] of the odic [illegible] profession, [illegible] reputation, have [illegible] is a strong [illegible] the day by a [illegible] new odic [illegible] magnets with [illegible] and many [illegible] from the [illegible] four inches long, and [illegible] horseshoe. He always found the [illegible] negative pole as on the [illegible]. Open [illegible] in a luminous down-like vapour. He saw [illegible] the nine-fold horseshoe [illegible] up forty [illegible] both poles, united into a column, and the [illegible] to the ceiling of the room. And even [illegible], which were doubtless strongly mag[illegible] glow so strongly in the absolute dark[illegible], that he could read the [illegible]

[illegible] commander of [illegible] in [illegible]

received from me magnets, crystals, &c., to take home and examine during the darkness of night. As he enjoyed but little sleep, he occupied himself with these for many hours in the dark, and gave me very exact accounts of what he saw. He saw a one-fold horse-shoe incandescent, both when closed by the armature and open; when open, the light was stronger at the poles than at the bend; when it was closed, the reverse. He saw luminous, flame-like, continually moving streams of light issue from the poles of the open magnet on both sides; from the southward pole, dull and yellowish red, about two inches long; from the northward pole, four inches long, bright and blue. They both ended in a smoky, vaporous essence, which reached to three or four times the length, and then was lost. He saw the entire horse-shoe enveloped in a luminous cloud as thick as one's finger, stronger when the armature was removed, weaker when it was in its place. In the latter case the armature partook of the incandescence of the magnet, and appeared red where it was in contact with the northward pole, and dark grey where it touched the southward pole. Thus an old man, of 77 years, saw the odic light over the magnet quite as well as a youth at the period of the development of puberty, or a young pregnant woman.

315. Dr. Nied, a physician practising in Vienna (No. 396, Suburb of Erdberg), 32 years old, was an invaluable discovery for me, since he is a physician, and a witness of the odic luminous phenomna from a caste,—that of the medical profession, namely,—in which my reresearches, contrary to all expectation, have frequently met with very unfriendly reception. Dr. Nied is a strong healthy man, kept in constant exercise throughout the day by a large practice, and of lively temperament. He nevertheless saw odic light of all kinds well in all directions; in particular, magnets with the metal luminous, large and small bars as well as simple and many-layered horse-shoes. He perceived smoke-like and flame-like emanations over a rod eight inches long, and one twenty-four inches long, and also over a one-fold, a seven-fold, and a nine-fold horse-shoe. He always found them half as long again on the negative pole as on the positive. Open horse-shoes were enveloped in a luminous down-like vapor. He saw the flame-like appearance over the nine-fold horse-shoe blaze up forty inches high, the flames of both poles united into a column, and the bright vapor rising above this to the ceiling of the room. And even the steel hands of his watch, which were doubtless strongly magnetic, appeared in a luminous glow so strong, in the absolute darkness of the profound chamber, that he could read the time on the dial plate.

316. Baron von Oberländer, of Schebetau in Moravia, about 35

years of age, continually on horseback in his duties as Ranger of Forests, and engaged in the woods in all weathers, of strong constitution, iron health, and free from illness all his life, accustomed to every vicissitude of cold and heat, rain and storm, found all magnets luminous that I placed before him in the dark. He saw the perfect form of strong and weak needles of four inches length weakly incandescent, and emitting flames an inch or more in length from both polar extremities. A pocket horse-shoe appeared to him to possess little flames on the poles from two-fifths to four-fifths of an inch in length, the smaller at the southward pole, the larger at the northward. He perceived a three-fold horse-shoe odically incandescent throughout its steel substance, and enveloped entirely in a delicate light, which was stronger toward the poles, and weaker toward the bend; flickering, unsteady flames on both sides, iridescent in brilliant colors, at the northward pole blue, green, whitish, and purple, of a hand's length; at the southward pole yellowish-red, and of a finger's length, all of such beauty that he delighted to remain looking at the novel sight. A large nine-fold horse-shoe, examined at a distance of one or two paces, appeared to him to have a powerful blazing light, nearly as broad as a man, and rising to such a height that it almost reached the ceiling, and throwing him into a state of astonishment from which he could not recover himself, until I told him that many others had previously seen this light as large at my house. This great luminous appearance seemed to him yellowish-grey, moving about, of a delicate, ethereal nature, and capable of being diverted by blowing on it. He could not examine it closely; it was so delicate and weakly luminous that it then disappeared from his eyes, but was always perceptible again as soon as he stepped back a pace. The nine-fold horse-shoe emitted flashing sparks laterally below its poles, flying off and whirling round to the side like extremely minute stars: he compared them to the sparks of crackling pine charcoal. This is the same observation that had already been noted down from the statements of Miss Reichel, and was figured in the illustrations to the first of these treatises.

But unquestionably the most remarkable individual of all the healthy sensitives, whose perceptions exceeded those even of many diseased observers, in strength, distinctness, and duration, was—

317. Josepha Zinkel, a girl of twenty-three years, daughter of Mr. Zinkel of Nussdorf, near Vienna. She is of the tall powerful race of the Austrian stock, different from anything else I have ever met with in Germany, perfectly healthy, and of a quiet, reserved temperament. She always saw steel magnets with their form distinctly marked out by luminosity. Two needles, each four inches long, appeared to her

to possess blue flames nearly or quite two inches long at the northward poles, and reddish flames four-fifths to six-fifths of an inch long at the southward poles. She found a rod eight inches long to have a blue flame four inches long at the northward pole, and a reddish one, six-fifths of an inch long, at the southward pole: a rod twenty-four inches long, blue for a hand's length beyond the northward pole; red, and half as long on the southward, with smoke. She saw a flaming light ten inches long on a rod five feet long. Medium horse-shoes presented sometimes flames, sometimes luminous clouds, from a hand's to an arm's length, over the poles; very strong ones, such as a nine-fold, flaming and vaporous masses of light, which ascended to the ceiling of the chamber, always larger, stronger, and brighter at the northward than at the southward poles. These experiments were repeated hundreds of times, with countless modifications, in the course of a daily pursuit of them during a long time, and were accompanied by weaker and stronger results,—of which I could not enumerate half,—according to the fluctuating sensibility of her subjectiveness depending upon her physical and mental condition at the particular epochs.

318. Pregnancy must be regarded as a particular kind of condition of health. I have luckily been able to obtain a few representatives of this among the sensitive. Mrs. Cecilia Bauer, wife of the inn-keeper Bauer, of the suburb Braunhirschengrund, Vienna, twenty-six years of age, in the sixth month of pregnancy, of tall, powerful frame, lively, open temperament, is a perfectly healthy person, and has been so all her life. But she is sensitive to a degree that I have seldom found, so that she exceeds even many somnambulists in excitability, and leaves all the other healthy persons far behind her. Scarcely, after she had entered the dark chamber, had I excluded the light and directed her attention to her hands, when she began to describe appearances of light appearing before her, at first weak, but soon so strong, that it was a real delight to carry on the investigation with her. She saw all steel magnets odically incandescent, and red and blue flames flicker at the poles, usually half the length of the steel itself. Weak horse-shoes seemed to her to have yellow and blue, stronger ones red and blue flames over the poles, mostly passing above into a beautiful iridescent play of color, which she described with vivid delight; the large nine-fold horse-shoe, which was then somewhat more weakly magnetic, appeared to blaze with a flame forty inches long, and from this smoke ascended to the ceiling. I never heard either a healthy or diseased sensitive speak with more decision and certainty of the odic luminous phenomena before them, than did this pregnant woman.

I must here also mention one more,—Mrs. Josephine Fenzl, who has already been named, (§ 302). During the experiments made with her in the year 1846, she was in her usual condition of health; those of 1847, however, during a period in which she was pregnant, and gave opportunity for comparison of the two conditions in one and the same sensitive.

319. None of these perfectly healthy persons knew anything about their most remarkable and interesting peculiarities, and they were not a little astonished at the discovery, under my guidance, of powers of which they had never before dreamt. The manner in which I come upon the trace of them, which I at once take up and follow, is now simply this: I inquire among my acquaintance whether they know any one who is frequently troubled with periodical headaches, especially with megrim, who complains of temporary oppression of the stomach, or who often sleeps badly without apparent cause, talks in the sleep, rises up or even gets out of bed, or is restless at night during the period of full moon, or in whom the moonlight in general is disagreeable; or who is readily disordered in churches or theatres, or very sensitive to strong smells, grating or shrill noises, &c.; all such people, who may be otherwise healthy, I seek after, and make a pass with a finger over the palm of their hands, and I scarcely ever miss finding them sensitive. When they follow me into the obscurity of my dark chamber, and remain there an hour or two, their surprise is excited by the perception of a quantity of luminous appearances of which they had not previously the slightest idea. The great number of people who are in this state of excitability does actually exceed belief, and I state it below rather than above the reality, when I say that at least a third part of the population are sensitive: for on every side on which I turn I meet with healthy sensitives, and I could in a few days collect not dozens, but hundreds, if it were requisite. It will, and must, soon be proved how little ground there is to doubt these asseverations. Sensitiveness is not a rarity among human beings, as I myself thought some years ago, but a very generally distributed quality, which after my accounts, will soon be discovered in every direction, and will throw open a new and not unimportant page of the human condition.

But let us follow the appointed course, and come now to the

b. Sickly Sensitives.

320. Under this denomination I comprise all those who are able, like the healthy, to follow their occupations, but from time to time suffer from indisposition and disorders which confine them to their room or to bed.

321. Miss Susanna Nather, thirty-seven years of age, daughter of an officer of Basle: I met with her sick in a convent in Vienna, with all the symptoms of strongly marked sensitiveness. When she was so far recovered as to be able to leave the infirmary, she accepted my invitation to visit me for some weeks at my estate, where I subjected her to daily experiments, to which we shall frequently recur. It was remarkable that, with great sensitive excitability to all that affected the feeling, she never could see the magnetic light in the dark. We thus find, on the one hand, very exalted sensitiveness, in persons who occasionally suffer from nervous disease, but whose optical apparatus does not enable them to detect the odic light; while on the other side we possess perfectly healthy persons, in great number, who see these luminous phenomena with the greatest ease and distinctness.

322. Miss Josephine Winter, at present in Vienna, No. 60, Suburb St. Ulrich, step-daughter to Mr. Schmal, the painter, of Grätz, nineteen years of age, tall, of a full habit, strong, healthy, full of gaiety, and at present perfectly healthy, passed through a violent nervous disease two years ago, during which she for some time suffered from spasms and somnambulism. A sensitive excitability has been left behind by this, which may be readily called out by reactions. She saw all magnets laid before her in the dark in a whitish odic incandescence. Needles eight inches long flamed at both ends to a length of an inch or more, both more strongly and blue at the northward pole, red at the southward. A long one-layer horse-shoe appeared to her to have a flame at the negative pole six inches, at the positive four inches long, both being themselves in a delicate luminous vapor. She found a three-fold horse-shoe odically incandescent, white, enveloped in light, and flaming to a height of eight to twelve inches at the poles; on one bright blue, on the other yellowish-red. The flame flared backward and forward when she blew upon them.

323. Mrs. Johanna Anschütz (*née* Steiner), wife of the above-mentioned Mr. Gustav. Anschütz, twenty-eight years of age, mother of two children, a lady of delicate nature, readily thrown in a state of reserve, susceptible as she was excitable to all impressions on the feeling, had suffered almost throughout her life from various acute diseases, which always terminated in a spasmodic condition, and not unfrequently brought on fits of somnambulism. For some years she has been healthy, but very slight mental shocks suffice to reproduce the latter at once. She was kind enough to submit to the trouble of testing her vision on the luminous phenomena, and saw a great number of them, both in my darkened chamber and at night in her own house. She saw two magnetic needles, four inches long, flame to a length of two-fifths to four-fifths of an inch at both poles. She saw a pocket

horse-shoe emit light at both poles. She perceived a one-layered horse-shoe, twenty inches long, luminous in its perfect figure, and diffusing, moving, luminous, flame-like vapor at both poles. She saw a three-fold horse-shoe luminous throughout its mass, and seamed with intense light at all the edges, especially at the edges of the poles. Another time, during menstruation, she saw a delicate luminosity flaming up eight inches long over both poles of the same three-fold horse-shoe. A five-fold horse-shoe seemed to her to have a luminous vapor of a hand's length at both poles. A seven-fold gave light only at the northward pole. She found a nine-fold horse-shoe principally luminous at the edges, and delicate flames sweeping up sixteen inches above the poles, which, according to her statement, required to be held at some distance from the eyes to be seen distinctly, becoming indistinct when brought too close, and disappearing when in immediate proximity to the eye. She described the flames themselves as so extraordinarily delicate and ethereal, that she could not compare them with a common flame; they seemed only a pallid luminosity, so immaterial that they could not be looked close at without, so to speak, dissolving into nothing. They were only to be perceived once only four-fifths of an inch, at another time ten inches long, disappearing when I applied the armatures, and flashing up when I removed them; moving unsteadily, sparkling, always larger and blue at the northward pole, smaller, duller, and reddish-yellow at the southward; in all cases marked somewhat more brightly and distinctly at the edges and corners of the poles.

325. Miss Wilhelmine von Weigelsberg, about twenty-three years of age, residing in Vienna, No. 451, Fleischmannsgasse, in the suburb of Wieden, with her aunt, suffers much from spasms and uncertain health, although she looks well. She saw magnetic needles four inches long glowing pale white throughout their steel substance, brighter towards the poles on both sides than in the magnetic axes. She found all the poles furnished with little flames, bluish on one side, and yellowish-red on the other. She also perceived horse-shoe magnets in an odic incandescence; a pocket horse-shoe, which I had given her, appeared to her at night, at her own house, to have smoke-like delicate flames on both arms, four-fifths to six-fifths of an inch long, a little smaller at one pole than at the other, unsteady, sometimes brighter, sometimes more cloudy, now larger, now smaller, occasionally blazing only at one arm. In my darkened chamber she saw, on a five-fold horse-shoe, only a short, weakly luminous spot on the southward pole, and a restless vaporous flame, an inch and a half long, on the northward pole. She perceived flame-like lights blazing

to a height of almost twenty inches on the large nine-fold magnet, illuminating the immediate vicinity.

326. A strange phenomenon referable here is that of a *blind sensitive*, the master cabinet-maker, Johann Friedrich Bollman, of No. 268, Ferdinandsgasse, suburb of Wieden, Vienna, a tenant there of a house belonging to Mr. Gustav. Anschütz, to whose friendly interest I owe the knowledge of this remarkable man. He is fifty-six years of age, born at Kiel, in Holstein, was, thirty years ago, servant in the laboratory of our distinguished physicist Pfaff, in that place; suffered for a long time from affection of the lungs, got cataract, and was unsuccessfully operated on by Prof. Jäger, and has now been blind for some years: that is, unconditionally blind for all shapes and material forms of things, but not altogether insensible to the general impression of light. The poor man no longer possesses a crystalline lens, but his retina is still healthy. Thus, rays of light which now fall upon his disordered eyes can no longer be collected into a regular picture, but, penetrating diffusedly through the opaque fluids of the eye, they arrive at the retina, and are conveyed to the mind by the power of sensuous perception. The necessary result of this is, that he can perceive light and color, but not form. When any one has on bright-yellow or bright-blue clothes, a young lady a green or red shawl, he detects the colors if they are strongly illuminated; but a green branch or a red door would produce the same effects upon him. Now this blind man happens to be sensitive. He was brought to me at Castle Reisenberg; I kept him there all night, and took him next morning to my apparatus in the darkened chamber. After remaining quiet in the dark for an hour, he, this blind man, saw a quantity of luminous phenomena, which I, who could see, was unable to discern; and when we necessarily moved backwards and forwards among the odically luminous objects, it *happened, perhaps for the first time since men have existed, that the blind led the seeing;* namely, Mr. Bollman led me. Our parts were exchanged. The daylight in which I was able to act was taken from me, but for him the odic light, which reacted upon him and not upon me, was increased. I shall return to all the details in their proper place; here I have only to notice that he perceived a little pocket horse-shoe lying upon a table as a luminous spot; that he did not at once observe a long one-layer horse-shoe when close to him, but when I removed it a step from him, and took off the armature, he discerned a sudden flash of light, which gradually disappeared after a few seconds. He observed this only at one pole, which I, when he directed my hand to it, recognised in the dark, by the marks upon it, as the northward pole. A three-fold horse-shoe remained permanently luminous to him.

He could not see the iron substance in its weak odic incandescence; but as soon as the armature was removed he detected a permanent light, and this again at the northward pole only. He described it as a roundish luminous spot, of about an inch and a half in diameter. A nine-fold horse-shoe produced a large luminous cloud, which spread its light almost forty inches round upon the neighboring objects. Thus, odic light traversed the vitreous humor of his eyes, and was received by the nervous plexuses of the retina, like other light, but did not impart to him any configuration of the shape of magnets, odic flames, vapor, or sparks, but only an impression of diffused light. The present case certainly affords a most rare and certain point of support as to the nature of the odic light.

327. One of the sensitive young women had told me that she had suffered from chlorosis in her childhood, and had taken particular fancies to certain kinds of food, especially to all raw substances. Since I already knew from other quarters how fond all the more highly sensitive are of raw food, I was led to the idea that chlorosis might perhaps be accompanied, among other things, by distinctly marked sensitiveness. In order to test this, I looked about for chlorotic patients, and soon learned that among my own work-people at Reisenberg Farm, there was a girl who had suffered unceasingly for three years from chlorosis. I at once subjected her to investigation. Anka Hetmanek, twenty-one years of age, short, but stoutly made, corpulent, esteemed as a spirited and industrious girl, of quiet character, a clever silk-spinner: has only menstruated once in her life: is free from headache, but suffers much from disorder of the stomach as well as chlorosis, and is attacked by the pain at all times. At the very first re-actions she proved to be perfectly sensitive. Every sensation that characterizes this appeared in her to its full degree. She saw all magnets odically incandescent in the dark, with a whitish light, even when the armature was applied. When it was removed, she discerned the odic flames over the poles, stronger and blue at the northward pole, smoking strongly at the southward pole; the electro-magnet with colored odic flames, &c.

328. Mrs. Francisca Kienesberger, thirty-nine years old, wife of a land-steward, mother of two grown-up sons, living at No. 97, Mittelgasse, suburb of Schaumburgergrund, Vienna, is very well-looking and stout, exceedingly lively, excitable, and unreserved. She suffers very frequently from headache, slight pains in the stomach, and occasionally from attacks of spasms. She is sensitive in a high degree. At my request, she stayed at my house, from time to time, for several weeks. She saw all magnets strongly incandescent. Two steel needles, four inches long, appeared to have flames nearly an inch long

at both poles. A magnetic rod, five feet long, almost as high as a man, seemed to have a flame eight inches long at the northward pole. All horse-shoes were luminous, both when the armature was applied, in which case the magnets were enveloped in fine luminous mist, as has been already described by Miss Reichel, and also when I took the armature off, in which case the poles exhibited flames. She saw a pocket horse-shoe four inches long, with flames of four-fifths of an inch. She saw a one-fold horse-shoe in a whitish glow, with flames as long as a finger on the poles, passing into luminous vapor. A seven-fold horse-shoe appeared to have lambent yellowish flames, as large as a walnut, on both poles, waving about on them; another time, during menstruation, she saw the same covered eight to twelve inches high with luminous flame-like vapor; a nine-fold horse-shoe appeared to her, in her usual condition, in a white odic incandescence, and to have flames twelve inches high, which rose up in luminous vapor in the room: at the period of her menstruation, the flame-like light seemed to blaze up five feet above the poles, ending at the top in bright vapor, which stretched up to the ceiling. When I opened the large magnet before her in the dark, she uttered an exclamation of surprise and delight at the splendor of the flames, the flying sparks and variegated lights of which then suddenly burst forth.

c. Diseased Sensitives.

329. Miss Amalie Krüger, thirty-seven years of age, daughter of a head-waiter of an hotel, resident at No. 27, Grosse Ankergasse, Leopoldstadt, Vienna, a woman of gentle disposition, serious tastes, well educated in languages, and thus more capable than many others of expressing herself clearly respecting her observations; of healthy appearance, and full habit. From youth she has suffered from many kinds of nervous affection; has, at various times, been a sleep-walker, which condition came and left her at intervals, and she has suffered much from spasms, which were very readily re-produced. At such periods she saw the magnetic flame very vividly, to a length of from four to eight inches. She visited me now and then for a few days, and very kindly devoted herself to the odic investigations, various reports of which I shall give in the sequel. In the darkened chamber she always saw the light flash up from the magnets most distinctly when I pulled off the armature, and at the moment when I applied it again. The vaporous lights which she discerned upon open horse-shoes were not large in proportion to her great sensitiveness, usually only about an inch long, and always visible on one pole alone, which constantly proved to be the northward. This was the

case with a pocket horse-shoe, a large one-layer, a three-fold, and a five-fold magnet.

330. Friedrich Weidlich, thirty-two years of age, formerly in the English navy, now an invalid, staying in Vienna, severely and incurably affected with hypertrophy of the heart, accompanied with spasms and periodical attacks of somnambulism. This man, I know not whether by his own fault or not, is in bad credit among the physicians of Vienna; I do not inquire into such matters, but I have seen that in the tests which I applied to his sensitiveness he always adhered to the truth, and gave me genuine accounts. From the abundance of experiments and observations I have now collected on the subject, it is wholly impossible for a sensitive to deliver me even a single untrue sentence without immediate detection, since with every new patient I again go through all settled questions from the beginning, and they are controlled beforehand, or, whatever any one tells me new one day, I repeat upon other sensitives the next morning; not to say that such a person, even if he were a graduate of physics, would be unable to see or guess the sense and purpose of the cross-questioning to which I subject him. At all events, all and every statement Weidlich gave me bore the stamp of exact rectitude, and held good in all cases under manifold controls: I have nothing to do with any other affairs he may be concerned in. He saw all magnets glowing palely with a whitish-red light throughout the substance of the steel, brighter toward the poles, almost dark in the axis. He found magnetic needles four inches long, emit little flames from both poles, larger from the northward than from the southward pole. In a subsequent experiment he gave the size of the former as two inches long, and the color bluish; the latter an inch and a half long, and yellowish. He described a long single-layer horse-shoe as having very thin flames at both poles: somewhat stronger, larger, and blue at the northward pole; smaller, duller, and reddish yellow at the southward pole. A three-layered horse-shoe possessed a flame on the northward pole of a hand's length, iridescent, but predominantly blue; and at the south pole a somewhat duller, smaller, reddish-yellow flame, and these rose up side by side, terminating in strong smoke. A large nine-layered horse-shoe seemed at first, when very close, to have a flame about eight inches high, with much vapor over it; but when I removed him a step back from it, he perceived the great tall column of light, which he had not seen before. He now described this as equalling the height and breadth of a man, intermingled with smoke above, which curled up to the ceiling of the room, and lighted up everything. He stated the color to be yellowish-red and bluish, and that it was in constant motion: when I blew

upon it, the column was distorted, but soon restored itself again: in a subsequent experiment, he gave the size somewhat less, but all in proportion; thus corresponding either to subjectively weaker power of vision, or objectively less intensity of the magnet.

331. Miss Clementine Girtler, eighteen years of age, daughter of a draper, residing at No. 63, Hauptstrasse, Wieden, Vienna, a delicate impressionable girl, had suffered for a long time from liver complaint, and had fallen into active somnambulism: during this, the moon acted uncommonly strongly upon her, and through the good offices of her physician, Dr. Horst, junior, who completely cured her, I was frequently eye-witness of the strangest abnormal affections. She saw luminous appearances issue from open horse-shoes in the dark, both from a small one, and from a seven-fold horse-shoe. I was not able to get her to my darkened chamber; I was therefore unable to institute more circumstantial trials with her; nevertheless the above facts are sufficient here.

332. Johanna Kynast, twenty-two years old, daughter of a baker at Waidhofen, living with relations at No. 127, Schmidtgasse, Braunhirschengrund, an extremely well-looking and stout girl, was laid up with a nervous fever five years ago, and since then has constantly suffered from nervous attacks, and from time to time fallen into a state of somnambulism, which continues for some weeks, then disappears for weeks or months, returns, and so goes on. She paid me a visit, and remained some days. At first she did not see much in the dark chamber, and that little with a remarkable degree of intermittence, although she remained almost an hour in the dark. Quite unexpectedly, she now fell spontaneously into the somnambulistic sleep. It endured for half an hour, and I let her continue it quietly until she desired me to awaken her at once. As soon as this was done, she saw well all odic light of human beings, crystals, substances, &c.; and magnets, even when the armatures were applied, all appeared to her in a delicate whitish light of odic incandescence. She saw both needles and bars of different sizes, as well as horse-shoes, with flames at the poles. A long one-layer horse-shoe had a flame two and a half to three inches long at both poles; medium horse-shoes longer and brighter in proportion to their strength; the nine-layered appeared to have a flame more than twenty inches high upon the northward pole, less than twenty inches at the southward; luminous greyish smoke streamed up more than five feet high above these. She described the flame of the northward pole as larger and rather bluish; that of the southward poles as smaller and reddish, passing into red. The whole vicinity was lighted by them.

333. Francisca Weigand, twenty-seven years old, sister of the hatter Weigand, residing at No. 30, Obere Pfarrgasse, Windmühl, Vienna, born in the district of Königshofen in Franconia. With an affection of the bronchi, she fell into a periodical somnambulism. This girl possessed a remarkable power of vision for the odic light, and through her obliging readiness most interesting results might have been arrived at. Unfortunately I was opposed in every way by a quacking physician, without any idea of the scientific value of the case which had unluckily fallen into his hands; the poor somnambulist was allowed to tell fortunes, and make a source of profit of her misfortune, and soon acquired a lamentable celebrity all over Vienna. This is just the way in which, in France and Germany, the most interesting phenomena of somnambulism have had a stigma cast upon them, and been brought into discredit in public opinion. I myself was present at one earnest reproof that was given to him by the worthy Professor Lippich on this account, but without effect, as the sequel only showed too well. I brought her some small magnetic rods and horse-shoes. She saw the metallic substance of all very well in the dark, glowing, duller around the axes, brighter towards the poles; a little rod four inches long exhibited to her a flame of two inches at the southward pole, of six inches at the northward pole. The horse-shoe, the armature of which she saw glowing, emitted flames from both poles when this was removed; that from the southward pole as long as the arm of the magnet, that from the northward equal to twice the length. Moreover, the entire horse-shoe was enveloped in a delicate mist of fire, as had been described by Misses Reichel, Atzmannsdorfer, Maix, and some of the most remarkable sensitives.

334. I have now added *fifty new witnesses to the six or seven original ones*, and, like the reader, I begin to tire of always relating one and the same thing, and wasting myself in repetitions. I could easily go on bringing forward many fresh sensitives and their statements; I think, however, that we have more than sufficient. Every *reasonable* doubt to which the five sensitive girls first named might have been exposed, must disappear before the multiformity and credibility of the facts, vouched for by persons differing most widely in age, sex, residence, position in life, and occupation, and by persons of the highest respectability,—facts, for the control and repetition of which, in other places, I have always furnished the most complete facilities. I know that, in spite of this, there will remain plenty of people who will not yet be satisfied—since there is such a thing as *unreasonable*

doubt; there is such a thing as absurd skepticism; and finally, there is also such a thing as malevolent skeptism.*

This I cannot and may not refute; I here have to do only with sensible, reasonably-judging people; with the friends of peaceful, scientific progress; and these will, I hope, have been satisfied with what I have brought forward, that is, so far as the establishment of the fundamental fact is concerned, that *magnets emit light in the dark*, which not all, but very many *healthy* and diseased persons are able to see with complete distinctness and certainty.

Uniting all these observations and depositions of evidence into a kind of collective testimony, we obtain the following *well-grounded axioms*:—

a. All steel magnets independently emit light,—odic light, in the *wider acceptation of the term.* This light appears under different forms, which exhibit unequal intensities, unlike colors, unlike densities, unlike motions, &c.

b. Not every eye is fitted to detect this. *A certain class of persons have the capacity;* the individuals may be healthy or diseased. Certain diseased conditions raise this power to a high pitch; but it is also met with, here and there, almost as strong in healthy persons.

c. The odic light is extremely weak, and is so much surpassed by every other known light, as to be thus rendered invisible. In order to discern it, the eye must be prepared beforehand by sojourn *in absolute darkness for hours.* The very slightest trace of light penetrating into a darkened space almost always renders the observation impossible; in any case quite uncertain.

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* A small society of physicians in Vienna lately afforded us a lamentable example of this. After half a year's continued investigation, these came to the edifying result that Misses Reichel, Krüger, Nather, and others, were nothing better than open liars and deceivers! I really pity these gentlemen,—altogether not less than three-and-twenty Doctors and Professors of Medicine,—that in twenty-two sittings they could not get nearer to the truth, and gradually went so monstrously astray with their sensitives, that at last all lost themselves together in open lying and deceit. I will not mention names. No one who reads the report which they published under the ægis of the Journal of the Medical Society of Vienna, in November and December, 1846, can avoid feeling a sensation of sorrow that powers which might have rendered essential service to science, if they had so willed, should have been wasted in so sad and useless a manner, even to the manifest prejudice of enlightenment. For, instead of ascertaining and bringing to light truths, the most contrary conclusions are dragged forward through a series of badly-arranged experiments; and facts, which were already to be regarded as secured, again enveloped in mystery. I will correct these mistakes, in notes, as often as I have opportunity in the course of my treatises; not because I believe that they require refutation with persons who know anything of such matters, for they refute themselves in the eyes of the initiated by their own complete emptiness, but because unscientific persons and foreigners must be guarded against deception.—*Author's Note.*

335. The establishment as firmly as possible of the fundamental proposition, that from the magnet emanates light—that is to say, a new, hitherto unknown something, which cannot be brought into connection with our existing conceptions of magnetism, whether or not it be luminous, or other peculiar properties inherent in it—was a point about which I could not spare any pains; and it was the more necessary that I should substantiate it by all the means in my power, since at present I have no method of material proof for the force, which can be used for universal illustration, of the kinds which exist in other physical experiments. But having once established it, and following the path of induction, by the enumeration of a superabundant amount of incontestible individual cases, given it the rank of a natural law, I have considered it unnecessary, and that it would be thought a tiresome and useless superfluity, for me to give the detail of all the further investigation of this subject in its immeasurable field, and every development of its specialities and individual parts, in the same way, through several dozens of nothing but repetitional and confirmatory experiments on fresh persons. I have, therefore, given this up from this point, and contented myself with supporting the rest of my observations by a less extended collection of testimonies; yet in all things in any degree important it will be found that I have never taken less than ten or twelve different persons for witnesses. I beg that the account of my further researches may be criticised according to this principle;—these treating of the appearances of the odic light in its different forms.

FORMS OF THE LUMINOUS EMANATIONS OF THE MAGNET.

336. So far as my researches extend at present, the odic light, in the wider sense of the term, appears in five forms, producing different sensuous impressions, namely, in the condition of:—

1. Incandescence.
2. Flame.
3. Threads, streaks, and nebulæ.
4. Smoke.
5. Sparks.

We will examine each of the various kinds of appearance in turn.

1. ODIC INCANDESCENCE ON THE STEEL MAGNET.

337. We have seen that a peculiar kind of luminous condition, in which the magnetic steel seems in a weak glow, and for which I have

not been able to find a better term than "odic incandescence," is one of the commonest and first phenomena, which almost all sensitives perceive in deep and long continued darkness. I have expressed my opinion on the nature of this light in the preceding treatises and now brought forward altogether, with the old and new, more than fifty eye-witnesses of the fact of its existence. The next question is, whether the odic incandescence remains the same under all external circumstances; whether, and if any, what modifications it is subject to.

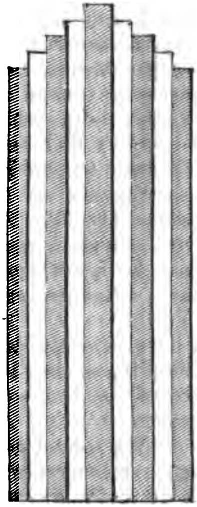
338. A simple bar magnet, twenty inches long, lying in the meridian, its northward pole carefully turned to the north, was shown to the youth Stephen Kollar, in my darkened chamber; he saw only a third part of the bar in distinct odic incandescence, this occupying the northward end; the other two-thirds almost escaped him, so that he only discerned slight indications of it. I showed the same rod, under the same circumstances, to the healthy maid Zinkel, Mrs. Bauer, Dr. Nied, Baron Oberländer, Mrs. von Varady, Mr. Rabe, Mrs. von Peichich, and many others. They saw it luminously incandescent throughout, strongest at the two poles, and decreasing toward the middle. But they did not find the color of these lights the same in all parts; the half turned toward the north had bluish, that toward the south a yellowish red light, agreeing with the colors of the flames emitted by the two poles. Moreover, Josepha Zinkel did not find the division of the bar into two parts equal; the bluish half was somewhat shorter, the reddish somewhat longer. I turned the bar round, laid it in the reverse direction,—namely, with the northward pole towards the south, and the southward towards the north, so that the poles of the bar and those of the earth coincided. The colors of the bar now became dulled and somewhat modified. The reddish half was now turned toward the north, the bluish toward the south; but the blue was duller, and had assumed a tinge of red, while the yellow was dulled, with a great intermixture of grey; the half turned towards the north here again presented itself as shorter, that towards the south as the longer. Thus, however the position might be changed, and the colors altered in intensity, the luminous half of the steel magnet turned towards the north always remained the shorter. Instead of a bar, I took *an open horse-shoe;* Prof. Ragsky, Mr. Schuh, Mr. Von Rainer, Mr. Hütter, and Mr. Delhez, saw the arms merely with a weak, dull, great light toward the poles. With stronger sensitives I placed both the poles in the meridian, sometimes towards the north, sometimes towards the south: in the first case the blue incandescence of the northward pole appeared enlarged and brighter, that of the southward subdued and dull red, passing into greyish-blue; in the second case, on the other hand, the

blue incandescence of the northward pole was weakened, dull, and had a tinge of reddish-grey; but the red light was heightened, more brilliant, and increased in size. The like was met with in some other experiments, in which I placed before Josepha Zinkel a horse-shoe magnet, sometimes standing with the poles turned upward, sometimes lying flat with the poles turned to *the east or west.* In the first place, she said the poles of both sides were less luminous when lying in the parallels than when turned vertically upwards. And it proved that the poles appeared to have more of a greyish-blue light when turned toward the east, and rather a tinge of reddish-yellow when turned toward the west. Moreover, whenever in these arrangements the northward arm of the magnet came to be on the north side, and the southward toward the south, the odic incandescence became more brilliantly blue and red; but on the other hand, whenever the arms were in the unconformable position, the flames were discolored and dull. (I borrow the terms *conformable* and *unconformable* from geologists and miners, who call a stratification which runs in a direction contrary to the general lamination of a mine, unconformable, in contradistinction to conformable, which coincides with the general parallelism. In the application of this, I call that position of a magnetic bar, horse-shoe, or other shape, conformable where the northward pole is turned towards the north, and the southward towards the south; the reverse position unconformable). I made the same experiments on Mrs. Kienesberger, with a three-fold horse-shoe, with the poles turned upward and the curvature downward; the northward pole sometimes toward the north, sometimes toward the south. In like manner I repeated them with a nine-fold horse-shoe on Miss Atzmannsdorfer, not to mention many occasional repetitions on other sensitives. The results were always exactly the same; I therefore omit repeating the description. These phenomena were in some measure parallel with the respective intensities of the magnetism of the earth, and of a magnetic bar, of which we know from M. Gauss that under our latitude they bear the inverse proportion of the weight of the eighth part of a cubic meter of the earth's mass and a steel bar weighing one pound. In other words, the magnetism of a common magnetic bar is, as a rule, more intense than the magnetism of the earth; and the former so much exceeds the latter that it cannot be overcome by it within the duration of an experiment; but at the same time the terrestrial magnetism acts so far that it visibly decreases the clearness and purity of the odic luminous phenomena of the magnetic bar, placed in the unconformable position; however, from the connection that exists between magnetism and Od, the allied phenomena accompany each other, as we have seen in many instances.

339. The result of a subsequent case, in which I placed before Josepha Zinkel a strong magnetic bar, twenty inches long, *in a vertical position*, with the northward pole turned upward, was similar. She saw the upper half of the steel incandescent in a yellowish blue-grey, the lower half reddish-white. When I turned it the other way up, with the southward pole at the top, she found the upper half yellowish-white, the lower reddish blue-grey. When the same was done with a horse-shoe, both poles retained their color, whether turned upwards or downwards, but they varied in color and intensity of light. But the magnetism of the steel, and the odic condition complicated with it, always exerted a certain degree of preponderance over the terrestrial magnetism, in each case the more marked the stronger the magnet was.

340. These conditions exhibited greater complexity in a *compound magnet*. I went through many careful experiments on this point with Miss Zinkel. I placed before her, in the darkened chamber, a nine-fold horse-shoe of great power, upright, the poles turned upward and in the conformable position, the armature removed. She saw the side of the northward pole in blue, that of the southward in red odic incandescence. This was the case when she looked at the broad surface of the layers. But when she placed herself before the magnet in such a way that she looked at the narrow, long side, so as to see the edges of all the layers, as in fig. 11, the picture of the odic incandescence changed. She now perceived that the layers did not all glow in the same colors; the middle, longest layer, which projected beyond the rest, and was the agent of the magnetism of the entire luminous bundle, was now seen to be blue in its odic incandescence on the *north side*. But the layer in immediate contact on each side had a different appearance—it appeared red. The next layers, that is, the second from the middle, were blue again, the third red; and the fourth and last, that is, the outer one on each side, were again blue. Thus the middle, and the second and fourth corresponding pairs of layers alone were blue; the intermediate, first and third pairs, were red. And the odic conditions were found exactly reversed on the southward side. Here the incandescent middle layer was red. The layer immediately applied to this on each side was blue, the second pair red; again, the third blue, and the

FIG. 11.



fourth and outermost pair red. The colors of the odic incandescence of each particular layer were thus regularly opposed on the south and north sides, but in alternate order with those to which they were applied by their faces. Now, since all the layers were originally arranged and attached together with magnetism of the same kind, consequently with odic charge of the same kind, a reversal of the polar condition, a change into the opposite polarity, must have taken place in the first pair of layers during the conjunction. But when I examined the layers with the magnetic needle, I never met with any corresponding change of the magnetic polarity; this remained invariably northward in all the layers of one pole, southward in all those of the other. Thus it was not the magnetic, but only the odic polarities, that had been reversed; and the odic polarities changed, not *because* the odic polarities had been reversed, but *in spite* of their remaining constant. The strength of the light was greatest near the poles, and decreased gradually toward the bend; in this direction the blue became duller and duller, and passed into grey at the middle of the limb, the light disappearing wholly from the eyes of the observer at the bend; the red passed through reddish-yellow into yellow at the middle of the limb, then into grey, and became imperceptible at the curvature. Of the layers individually, the large middle, and the fourth, outermost pair, were most strongly luminous at the two poles, the intermediate pairs the weakest. Finally, when I placed the horse-shoe with both limbs in parallels, so that the flat sides of the layers were turned towards the terrestrial poles, the dissimilar poles of the nearest layers, turned towards the terrestrial poles, were in every case more brightly luminous, at both poles, than the more distant poles turned in the other direction, which gave a duller light.

341. I find an account of these experiments, as performed on Madame Cæcilie Bauer, given in the following words in my journal:—"She saw the large nine-layer magnet in bands of odic incandescence, like Mlle. Zinkel, both limbs of the large middle layer blue on one side and red on the other; in like manner both limbs of the outermost pair of layers uniformly blue and red when the entire horseshoe stood conformably vertical, and with the poles turned upwards." Further:

"*a. On the entire northward limb:* the first pair of each side, next the middle layer, appeared red; and the eastward layer more cloudy and more dull; the western brighter, and with a tinge of violet.

"The second pair, that is, the intermediate pair on each side, grey all over, more dull on the eastward layer, brighter and yellowish-grey on the westward.

"The third pair again seemed red, greyish-red on the eastward layer, pale orange on the westward.

"The fourth, last, and outermost pair on each side, blue; dark greyish-blue on the east side; sky-blue to pale-yellow on the west side.

"*b. The entire south limb*, where the middle layer was red: the first pair, applied on each side to the middle layer, were blue; the layer situated on the east side being rather greyish-blue, that on the west light blue.

"The second pair, that is the intermediate, grey; more dull to the east, and brighter, with a yellowish-red tinge, toward the west.

"The third pair blue again, toward the east,—passing rather into dull grey: toward the west, lighter,—passing from blue into yellow.

"The fourth, outermost pair, red on both sides; on the east side greyish-red; on the west side yellowish-red.

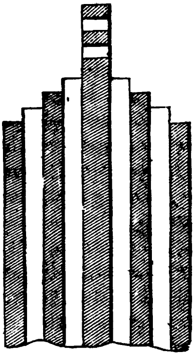
"The banding was a distinct alternation of incandescent layers of brighter to darker, but not of blue and red alone as Josephine Zinkel had seen, but an alternation of these colors, combined with a general admixture of grey on the east, and of yellow on the west; so that all these tints were imbued on the east side of the middle, principal layer, both on the north and south limb, with a shade of grey; while all those on the west side had a yellow cast—slight, but quite perceptible; this was a kind of transversality, therefore a further complication. On the greyish, east side, the vividness of the coloring was generally troubled, diluted, and dulled; on the yellowish, west side, strengthened, heightened, and rendered more brilliant." We shall return to this hereafter, when I speak of the colors of the odic light.

342. I traced the principal phenomena of this experiment also on the far less sensitive Miss Josephine Fenzl. She did not see any clear distinction of color between the layers, but an evident change from brighter to more dull, alternating. The brighter layers seemed to her pale reddish-grey; the duller, pale bluish-grey. Thus, her observation was sufficient to afford a certain amount of confirmation to that which her predecessors had seen.

343. The same phenomena was produced in another way. I placed four magnetic bars of equal size, as an armature, upon the large nine-layered horse-shoe. I had proportioned the length and breadth that each fitted exactly, like an armature, on the poles of the magnet, and all four were so laid upon the poles, that in closing it they were piled one upon another, all their northward poles turned toward the southward, all their southward poles toward the north-

ward limb of the horse-shoe. I allowed them to remain, thus arranged, for twenty-four hours, with the poles of the horse-shoe turned upwards and conformable. When I led the maid, Josephine Zinkel, to this, in the darkened room, she saw these bars varying among themselves in the banded condition, alternately red and grey incandescent, as in fig. 12. Immediately on the blue pole of the horse-shoe lay a red, and red-flaming bar; upon the red pole of the horse-shoe the same bar, at its other end, exhibited grey odic incandescence and blue flame. The succeeding bar had the reverse colored light; the third the same as the first; and the fourth the same as the second. When I removed all the little bars and examined them, I found them all southward polar at the one end where they had lain upon the blue pole of the horse-shoe, and all northward polar at the opposite end. Thus there was no magnetic alternation of the poles of the bars, as they lay upon the poles of the horse-shoe, but nevertheless an od-polar alternation of coloring.

FIG. 12.



344. Thus the odic polarities are reversed when several like poles are placed side by side and coupled together. They then form alternating layers, and this in spite of the magnetism, which remains unchanged. Therefore we had here *negative magnetic poles in red odic incandescence*, and *positive magnetic poles in blue incandescence*, alternately stratified with negative magnetic poles of the usual blue, and positive, with the usual red odic incandescence.

This surprising phenomenon is one of the very striking distinctions between magnetism and Od.

With a view to strengthen this appearance, I placed a *bar magnet, twenty inches long*, near the side of the nine-layered horse-shoe, with the *unlike poles*. But the result did not correspond to my expectation. When I brought the northward pole of the bar to within about two inches of the side of the southward pole of the horse-shoe, the red odic incandescence of the latter was certainly evidently increased, but the banding vanished, and Josephine Zinkel now saw nothing but full red layers, without any bands at all. When I made the same experiment at the other pole, with the corresponding modifications, she saw the compound horse-shoe simply in a blue odic incandescence. Thus the increase of the magnetism by magnetic influence removed the banding, the odic alternation of the layers, and raised one pole to exclusive power odically as well as magnetically.

When I in like manner brought the *like poles* near together, the result was still more unfavorable; all odic incandescence was extinguished, both red and blue color vanished.

I now wished to test the influence which the *poles of crystals* might exert in such cases. Since the magnet acting upon magnetism disturbed the odic luminous phenomena there, it was quite conceivable that a pure odic influence, without magnetism, might influence in a different way the odic phenomena which the compound horse-shoe afforded. A totally different result was really produced; for when I brought the positive pole of a very large rock crystal, sideways, to within four inches of the northward pole of the horse-shoe, not only did the banding of the light and difference of color not decrease, but the blue of the alternate layers increased considerably in distinctness and beauty, while the red became greyish-red. The same took place when I brought the southward pole and the negative pole of the large rock crystal near together, the red layers now becoming of a far brighter red than before, and the blue ones between them perceptibly of a more dull greyish-blue.

But when I approximated the positive crystal pole and the southward pole of the magnet, or the negative crystal pole and the northward pole of the magnet,—that is, like poles together,—all odic light of the same polar quality was dulled, and disappeared from the eyes of Josephine Zinkel almost entirely; while, on the other hand, the opposite kind of light was rendered more vivid and stronger.

This led me to investigate the *influence of the animal odic poles.* I turned my right and then my left side to the *positive limb of the compound horse-shoe;* the odic incandescence was not extinguished in either case; on the contrary, in the first the odic incandescence, and the luminous force of the red layers, increased, and the blue ones became duller; in the second the blue increased, and the red was rendered less bright. When I did the same with the *negative limb of the horse-shoe,* my right side produced an exaltation of the red and a dim condition of the blue layers, while my left rendered the blue brighter and the red more dull. Thus, each pole increased the odic color of the opposite pole, and depressed that of the same pole; and thereby it especially called out the banded condition of the layers of the magnet with great distinctness to the eyes of Josephine Zinkel.

From all this it follows, that *the magnet acts quite differently from crystal-od and biod, &c., upon the colors of the odic incandescence of steel magnets;* i. e., *that the Od associated with magnetism affects the phenomena of odic incandescence in the steel magnet in a way es-*

sentially different from Od unassociated with magnetism, such as emanates from crystals and living organisms.

345. The *completion of the magnetic circle by the application of the armature* exhibits great influence on the strength and distribution of the odic incandescence of the steel magnet. It has already been mentioned several times that the strength of the light of the odic incandescence is greatest toward the poles, and least toward the middle in the magnetic axis. This is the case when the magnet is open; but when the armature is applied, the luminous appearances are altered. I placed the armature upon a one-layer horse-shoe before Josephine Zinkel in the darkened chamber. The first thing she remarked was, that this armature, which was previously only whitish, like all iron, and weakly illumined, became at once much more strongly lighted; next, that the color changed and divided into two, namely, into bluish and reddish. The side lying toward the north became reddish, that toward the south bluish. This experiment was repeated some months later with a five-layered horse-shoe, the poles being turned upwards. The same difference of color was produced in the armature. The direction toward the west also produced this result. In like manner M. Sebastian Zinkel saw the armature red at the negative pole of the horse-shoe, and bluish-grey at the positive. This was repeated with Madame Bauer, Miss Winter, and others. Miss Sophie Bauer scarcely perceived the armature so long as it lay free; but when I applied it to the poles of a horse-shoe, she at once saw it become illuminated more strongly at the two sides than in the middle. These observations are explained by the circumstance that an armature is not a mere conductor of magnetism, but that it becomes itself a magnet by the magnetic induction as soon as it is applied to the poles of another magnet, and that the poles of the two must be opposed to one another. This proposition, deduced from theory, here found its practical confirmation in the direct observation of the sensitive.

346. The effect upon the one-layered horse-shoe magnet was, that the poles immediately decreased in luminosity; while light, which had been scarcely perceptible at the curve, increased rapidly considerably in strength, so that a kind of equalization of the odic incandescence over the entire horse-shoe resulted, with distinctly predominant brightness at the curvature. The bluish incandescence of the negative limb, and reddish of the positive, now reached, in almost uniform distribution, down to the curvature, and appeared almost to touch at the point of transition. Even the curvature itself now shared in these disturbances of coloring. Its two halos, red and blue, were subjected to the same influences as the corresponding limbs,

and were charged in the same way as their like poles. Repeated another time, for control, with a five-layered horse-shoe magnet, the open poles, originally far surpassing the curvature in odic incandescence, became more dull through the application of the armature, while the curvature became brighter than the latter. M. Delhez saw the polar region of the two limbs of an open horse-shoe magnet much more brightly incandescent than the curvature; but when I applied the armature the light became much more equalized over the whole horse-shoe, without, however, becoming perfectly uniform. These statements agree well with the theoretical notions which we form of the processes. The accumulation of the magnetic essence at the poles is relieved by the armature, and thus is allowed to become in some degree equalized throughout the space of its field of action.

347. As to the *intensity of the light* of these odic luminous phenomena, its distribution over the different parts of the magnet is not constant, but exceedingly variable,—so far, on the one hand, as the terrestrial magnetism, and indeed other agents also, such as the electricity of the earth and air, sunlight, human hands, and other neighboring Od-emitting objects, more or less affect it; on the other hand, as magnetism and Od are distributed in unequal accumulations in the parts of a magnetic bar, in consequence of their peculiar attractive or repulsive forces. All these influences act, sometimes in one, sometimes in another direction, more or less dislocating the odic poles and the focus of their luminous forms. To calculate all the factors interfering here will not be a light task in any time to come. Nevertheless, I have collected a few observations, and will set them down here.

348. Madame Cæcilie Bauer saw a number of magnets lying upon a table in the dark, but found the strength of light of their odic incandescence very unequal: she described many, at the first glance, as very beautiful and brilliant; others dim, obscure, and dull. I arranged them in a row, proceeding in order from the dullest to the brightest. Then I tried them by daylight. It was found that the strength of the light did not keep pace with the amount of weight the magnets of different sizes would support, but in all cases with the magnetic intensity. Simple horse-shoes, which acted upon a magnetic needle at a great distance, were more strongly incandescent than a nine-fold horse-shoe, which would support ten times the weight, but did not act upon the needle at so great a distance. *The intensity of the odic incandescence, therefore, kept pace with the magnetic intensity.*

349. All the sensitives who possessed any distinctness of vision saw the two poles of bar magnets more luminous than the axis.

Misses Reichel, Weigand, Atzmannsdorfer, Glaser, Madame von Varady, M. Rabe, Baron August von Oberländer, Baroness Natorp, M. Anschütz, and others, saw this with the greatest clearness.

350. The same was the case with the horse-shoe magnets. Among the observing witnesses for this I find marked in my papers are M. Delhez, Madame Josephine Fenzl, Madame von Peichich, Misses Sophie Pauer, Ernestine Anschütz, Weigand, Glaser, Baroness von Augustin, Madame Bauer, M. Sebastian Zinkel, Dr. Nied, Baron von Oberländer, Madame von Varady, M. Johann Klaiber, Prof. Ragsky, and M. Hochstetter. All agreed in this,—that in an *open horse shoe magnet* the limbs are most luminous near the poles, and dullest at the curvature, towards which the odic incandescence gradually decreases. Madame Josephine Fenzl observed this on a simple pocket horse-shoe, on a five-layered and on a nine-layered magnet; Madame Bauer on a single-layered; Miss Pauer on a three-layered and a pocket horse-shoe magnet; Klaiber and M. Hochstetter on several horse-shoes.

351. I showed to Madame Bauer, Josephine Zinkel, Baroness von Natorp, Madame von Tessedick, Madame Kienesberger, Baroness von Augustin, and Johanna Kienast, in the dark, a large *electro-magnet* produced by a voltaic element. Here, also, all found the open poles more brightly incandescent; the curvature, indeed, luminous, but with far less strength.

352. The condition was altered when I closed the *magnet with the armature.* All the witnesses just named then immediately saw the strength of the light diminish at both poles, and rapidly increase at the curvature; while the intensity of the light over the entire horse-shoe, including the armature, was simultaneously exalted, and in some degree approached to an uniform distribution through the magnetically-acting mass. In most cases this went so far that the curvature surpassed the poles in luminosity in particular. Miss Pauer, the girl Zinkel, and Madame Josephine Fenzl, decided most absolutely that there was stronger light at the curvature. The experiments were modified and frequently tested on the two latter with three-fold, five-fold, and nine-fold magnets.

353. At the same time the odic incandescence was heightened in the armature also, brighter at both ends when it lay upon the poles, duller in the middle, between the two poles, where it was free. Miss Sophie Pauer and the girl Zinkel saw, in some cases, the poles, in some others the armature, most brightly illumined. Madame Kienesberger, Baroness von Augustin, and Miss Atzmannsdorfer, saw the poles brighter than the armature in all the cases submitted to them. It appeared to me as if, in all cases where the armature was suffi-

ciently polished, and fitted the ends of the poles well, thus offered many points of contact, the poles were duller, and the armature brighter, and this inasmuch as it then conducted the magnetism better and more perfectly; thus, more completely and rapidly removed it from the poles. The more rapid the conduction, the duller the poles; the slower the conduction, the greater the accumulation of magnetism and Od at the poles, and therefore the brighter there: the light of the armature is probably always the same, but is in some cases surpassed by the poles; in others, the intensity of the light at the poles is inferior.

354. When I closed a horse-shoe magnet with another one instead of an armature, the results were modified in some degree. The curvatures of both rapidly became brighter than when they were open, and the poles more dull: but this did not go so far as that the curvatures surpassed the poles in intensity of light; the four combined poles had rather the preponderance of brightness. This was seen by Miss Sophie Pauer and the girl Zinkel, both perfectly healthy, exact, and trustworthy observers. While in the magnets closed by an armature, the curvature had acquired the greatest proportion of light; here, in those closed by another horse-shoe, the poles always retained it.

355. The reason of this difference may be conceived. When two horse-shoe magnets are joined, double the quantity of magnetism and Od must be at once conducted through each. Moreover a greater quantity of magnetism becomes induced and put into activity by the opposition of the poles. Therefore there is, on the one hand, a far greater quantity of the dynamic brought into the circuit; while, on the other, the channel for this is obstructed, since iron is a much better conductor of it than the hardened steel, endowed with so strong a coercive power: now an armature is made of iron, while a horse-shoe magnet is made of hardened steel. Then the armature is also ten times smaller than a horse-shoe; thus, rapid conduction can take place through the former, it being ten times slower through the latter. Thus, a much greater quantity of the dynamic essence must pass through a much less easy path when a horse-shoe is closed by another horse-shoe, instead of an armature. The consequence of this is that the dynamic, partially obstructed in its conduction away, becomes concentrated around the poles, and thus becomes more clearly evident there by odic light. This state of a certain degree of limitation approaches to the totally arrested, namely, that when the horse-shoe is not closed at all: and we saw there that the light of the poles is the greatest, and always surpasses that of the curvature

in strength. All this, therefore, agrees very well with theoretical deduction.

356. We have already seen what a powerful influence the position of the magnet, as to north or south, exercises over the *colors* of the odic incandescence; it affects in like manner the *degree of intensity of its light.* All the sensitive found every *magnetic* bar, lying conformably, in the meridian, incomparably more brilliantly luminous at the two poles, than one lying unconformably, in which the odic incandescence appeared dull and troubled. The terrestrial magnetism and the Od of the terrestrial poles co-operate in the one case, and thus strengthen the odic emanations; in the other, they are adverse, and weaken them, thus interfering with the double force of the earth. This simple case has been repeated so many hundreds of times, and so often occurs incidentally to other experiments in the course of these pages, that I will not waste room by special enumerations here. It is somewhat more complicated now and then in the application of *horse-shoe magnets;* we have already examined them in the open condition in respect to this, when speaking of the colors (§ 338): I will here relate the experiments which I made in a similar manner with horse-shoe magnets closed by their armatures.

A. *When an armed horse-shoe lay in the meridian, with the poles turned to the north*, the northward limb was brighter, the southward limb duller. When in the reverse position, with the poles *toward the south*, the intensity of the light was distributed in the reverse way in the limbs; the southward was brighter, the northward more dull.

B. When a horse-shoe stood erect, armed, the limbs conformable *with the poles turned upward*, Josephine Zinkel found the poles become bright in the dark, the curvature grow dull.

C. When the closed horse-shoe, in the conformable position, was turned the other way upward, so that the *armed poles were directed downwards*, and the curvature upwards, the points of most intense light were changed. They left the vicinity of the poles, and established themselves at both sides near the bend, just where the curvatures began. Thus, that part of a closed magnet which was *turned downward*, (whether pole or bend,) was *somewhat* LESS *luminous, while that turned upward was always somewhat* MORE *so.*

D. When an armed horse-shoe lay, with the limbs conformable, in the magnetic parallel, Josephine Zinkel saw in the dark that when the poles were turned toward the *east* they became more dull, while the curve became brighter. But when I turned the horse-shoe round, and directed the poles toward the *west*, she saw them become brighter, and the curve duller. Thus, that part of a closed magnet *which was* *turned toward the east*, (no matter whether curve or poles,) *was less luminous, while that turned toward the west was always more so.*—She also perceived the armature to be brighter when lying in the west, duller when in the east, conformable to its substitution for a curvature. Taken together, therefore: *The bend and poles of an armed horse-shoe magnet were more luminous when they were turned upwards, toward the sky or toward the west; the luminosity was weaker when they had the direction toward the ground or toward the east.* (Vide § 536.)

357. These experiments were repeated at various times with simple and compound horse-shoes, and the results always described in the same way by the beholder. At the last time of trial she added a new, but slight distinction, namely, when the poles of the horse-shoe lay to the east, she found the *north limb lying on the north side somewhat duller*; and the south limb, on the south side, brighter; on the other hand, when the poles were turned toward the west, she found the *north limb lying on the north side brighter*, and the south limb lying on the south side duller. Neither distinction was great, but still quite evident. These distinctions are in all cases delicate, and require for their examination good, quiet, and exact sensitives; and still more, a truth-loving, unprejudiced, careful and patient physicist. Persons with whom dogmatism is better than truth, who preconceive an opinion and seek to obtain a triumph for this over all others, are not fitted for such investigations; they entangle a matter so delicate, and tear the intermingled threads instead of separating them.*

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* Thus it happened in Vienna. It was thought to make an end of the troublesome Magnetism with one blow. Finding a suitable opportunity, all the medical men who had pronounced themselves quite unfavorable to it, collected together, and called themselves a Commission of the Medical Society, and began a presumed annihilation of it. Even the title of the Commission was an assumption; for the Medical Society did not commission any one,—in fact, had no knowledge whatever of the matter; nay, having heard of it at last, after the irregularly-effected insertion and printing in the "Vienna Medical Journal," the Society formally disclaimed it in the Report of the Meeting of the 16th of November, 1846, denying any share in this one-sided and arbitrary conduct of certain of its members. I myself, although an honorary member of this Society, heard of it accidentally, long after, when many trials had been made with Miss Reichel. Indirectly, and under cover of some apparent civilities, my treatises were made the objects of attack: but near as I was, it was not thought fit to invite me to the trials; it was feared that I might in some measure solve and correct the contradictions and incongruities of their labors. But it was not explanation and scientific truth that were wanted here; only dogmatism in the opinions of a coterie of practising physicians. An impartial commission, chosen by scrutiny, by and from the Medical Society itself, to represent, by *competent persons*, all different opinions, would have been a very good and praiseworthy thing,—

358. When I closed a *horse-shoe magnet again with a horse-shoe*, instead of an armature, like poles being brought together, the results of the odic incandescence were again somewhat different. The poles at once became more dull, and the curvatures brighter, than they had been before; but Josephine Zinkel saw the limbs of both horse-shoes, when lying with their longitudinal direction conformable, in the parallels still always somewhat more brightly incandescent at the four poles than at the two curvatures. On both sides, the light was *strongest one-seventh part of the distance inward from the poles*, running on in decreasing amount to the curvature. Thus, the poles had lost less in incandescence toward the curvature, than when the magnet was closed with the armature. In a subsequent experiment, she compared the luminous condition of the many-layered curvature to a white jelly; that is, the translucent white odic incandescence of the steel substance, resembled in the dark a transparent luminous jelly.

359. When I pulled the horse-shoes asunder, all the poles became brighter, but soon reassumed their natural luminosity, and the curvatures recovered their dulness. This was confirmed in all experiments, made at far distant intervals.

360. I obtained greater distinctness and corroboration of the foregoing when I closed the horse-shoe, not with the poles of another, but with its curvature, as in Fig. 13. The result on the horse-shoe lying flat was exactly as when I had closed it with an armature: duller poles and brighter curvature downward, until the poles made the arming, as in Fig. 14, I again obtained brighter poles and a duller curvature on the horizontal magnet. Both phenomena are confirmations of the

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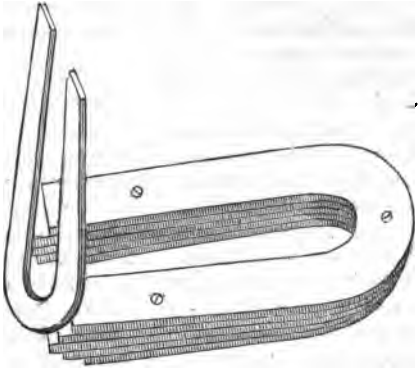
would doubtless have brought valuable truths to light, and established them by its weight; a one-sided, party club, of mostly young, almost wholly uninformed persons, interested in their views of the question at issue, had no authority, and deserved none. I shall throw some light upon the value of their labors here and there.—*Author's Note.*

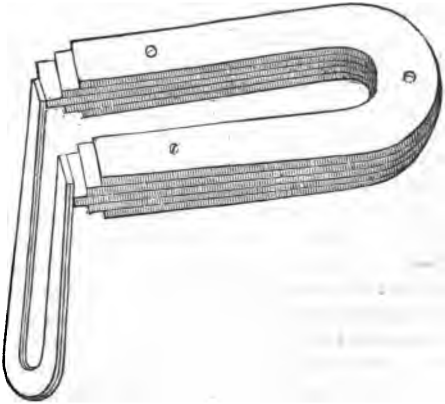
If the Baron required analogies to assure him of the identity of feelings prompting the actions of medical practitioners, we could afford him not a few specimens from our London physicians, surgeons, and apothecaries. The philosopher, in his capacity of human being, may occasionally find himself stung and teazed by the conduct of men of paltry habits and unworthy feelings. His contempt for the opponents of truth should, however, melt into pity; and, instead of regarding men as reptiles and vermin, he should deplore the existence of those repulsive agencies in their brains which incapacitate them for the more transcendental thoughts and enjoyments of science. Empirics by habit, how can they at once emerge into the higher grade of thinkers? The Baron, whose discoveries are leading to a more expanded mental philosophy than any hitherto conceived, can afford a large charity towards those who oppose themselves to the progress of enlightenment.

above-mentioned observations, and were gone through three months later with Josephine Zinkel.

361. The cause may be traced back to two reasons. One is the shorter road, which the magnetism or the Od has to take in its circuit when it is closed by a curvature instead of an entire horse-shoe; the other is the stronger mutual effect and greater quantity of magnetism, which are set in action and circulation by the conjunction of two magnets, where the magnetism is then more accumulated at the poles, and, on account of its greater quantity, cannot be conducted away so rapidly, which finally also leads on to diminished conduction. And, since the Od advances somewhat slowly through matter, this strengthens the theoretical probability. How ever, it is not yet time for this; we will first merely collect and arrange facts.

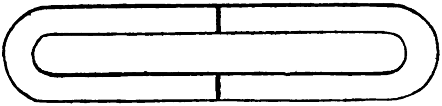
Fig. 13.





362. The delicacy of the distinctions which may exist in these subjects is proved by the further remark that the observer could also detect a distinction in the degree of strength of light where the limbs of both horse-shoes were placed together so as to form straight lines, as in Figure 15; or when they were in contact at right angles, as in Figure 14. In the first case she saw the poles glow somewhat more brightly, in the second more dimly; while the curvature was rather

FIG. 15.



brighter. It must, in fact, be assumed that when attached in a line, the two horse-shoes exerted greater provocation upon each other than when they made an angle together, and the directions of the force crossed. The rectilinear protraction of the magnetic bars by their odic flame shows that the projectile force is propagated in a straight line in the direction of the bars and limb.

363. Let us now turn our attention to the course of the intensity of the odic incandescence on the *other horse-shoe*; that *used as the armature.* When its curve was placed against the poles of the horizontal magnet, as seen in Fig. 13, though previously scarcely perceptible to Josephine Zinkel in the dark, it rapidly became odically incandescent, blue on one side, red on the other. At the same time, its poles above glowed more brightly. As I now drew it slowly down the poles of the horizontal horse-shoe, the curvature gradually became still brighter, while its poles became step by step more dull. When I at length brought the poles to the poles, as in Figure 14, the curvature attained its greatest, and the poles their least brightness, although they still remained always tolerably strongly luminous; and then the curve was brightest, the poles less brilliant, the limbs dullest, yet the first never so bright as when the poles were closed by an armature. All this agrees exactly with the various observations related in the last paragraphs.

364. The intensity of the odic incandescence also showed differences at different points of the steel magnet, even at equal distances from the poles. Madame Johanna Anschütz, Misses Atzmannsdorfer, Winter, Weigand, Nowotny, Glaser, Reichel, and others, always saw the *edges* more luminous than the surfaces of steel bars; all *corners* again more luminous than the edges; and *all* points still more so than mere corners. This they found to be the case also in the applied armatures; the edges and corners were always brighter than the faces: indeed, they often saw the edges emit light when the surfaces were still dark and invisible. I showed Miss Atzmannsdorfer, in the dark, a magnetic bar twenty inches long, brought into a narrow parallelogram, and thus closed by means of three armatures; she saw the entire quadrangle emit light, the magnetic bar more strongly than the armatures, but all seamed round, as it were, at all the edges, with threads of light. The healthy Miss Pauer, M. Rabe, Sebastian Zinkel, and others, described the same thing many times. Madame Bauer saw a one-layer horse-shoe more strongly and brightly

seamed when it was open than when the armature was applied, on which the threads of light round the edges at once became duller. She perceived the seams both on the inner and outer edges of the horse-shoe, but the outer were lighter than the inner. Moreover, she found them brighter on the positive than on the negative limb. The girl Zinkel described these phenomena most accurately. I showed her a one-layer and a three-layer horse-shoe, each both open and closed with the armature. She saw the *single-layered, when open*, bounded by a seam of strong light at all the edges; the seam of the outer edges was lighter, both around the curvature and at the poles; so that in the open, single-layer horse-shoe, the greatest intensity of light ran round the outer boundary edges. When the *one-layer was closed*, it was likewise seamed with light on the inner and outer edges. But in this case the edges of the curvature were somewhat lighter inside than outside; but this greater light vanished by degrees towards the poles, and gave way to another similar, which now displayed itself on the edges of the limbs, and attained its maximum of light about a seventh part of the length of the limb below the poles. On the *three-layer horse-shoe, when open*, the border of the inside of the curvature was always brighter, decreasing and disappearing toward the poles; and here again the outer edge poles acquiring the greatest light, instead of the curvature. When the *three-layer was closed*, she saw all its outer edges more brightly seamed than the inner, even on the outer edges of the armature. We must not forget here that the three-layer horse-shoe is only armed on the middle layer, and not on the two shorter side layers; this gives rise to the differences in the strength of light of the seaming between this and the one-layered magnet. She always saw every armature with lighter seams on the outer edges, and duller on the inner.

365. From the foregoing may be deduced the rule that the seams of light at the edges are *more intense* when the magnet is open, and its odic tension throughout the entire mass of steel thereby (probably) exalted; on the other hand, that they decrease in intensity of light outside when the magnet is armed, their odic tension being lowered, and the dynamic activity set in motion, thus turned more inward, so that the *seams of the inner edges then increase in intensity of light.*

366. Madame Jos. Fenzl, Madame Bauer, Madame Kienesberger, Sebastian Zinkel, and Wilhelmine Glaser, stated that the *most brightly luminous place*, both of bars and open horse-shoes, was always a spot, not on the poles themselves, but some distance down from them, about *one-seventh of the length of the limb toward the axis.* This was the case with magnets, open or closed by armatures, mag-

nets closed by magnets, or any other arrangement; when they were closed, the curvature as a rule was brighter than the poles, but the spot always remained brighter than the curvature. It is a well-known fact that the focus of the magnetic attraction is situated exactly at that point: thus this magnetic point and the focus of the greatest intensity of odic incandescence coincide. Josephine Zinkel observed a remarkable case of change of position of the brightest spot of light. When I had placed a horse-shoe, closed by an armature, in the vertical position, but with the armature and poles downwards, and the curvature upwards, these maxima of light lost their position near the poles and changed to the curvature, to both sides of this, at its junction with the limbs, that is, about one-seventh of the distance down from the curve, which here took the place of the armature. When I closed one horse-shoe magnet with another, the phenomenon appeared at the poles of both magnets, about one-seventh inwards upon each, and, indeed, more distinctly here than when the armature was used, for the poles thus closed remained brighter near the curve. This even passed into unmagnetized iron bars; when they had become magnetic by induction, the girl Zinkel always saw the focus of light one-seventh of the half-length inward from the poles towards the middle.

367. *An artificially excited, very bright point of odic incandescence, is produced by rubbing one magnet with another.* At these points, namely, where the poles of the rubbing magnet come in contact with the rubbed one, each time a very intensely luminous spot is formed on the latter, which moves forward over it very exactly with the former. The point of the rubbed magnet which is touched is set in luminous odic incandescence by the rubbing; but this is extinguished again as the rubber advances, and goes on along with this. This observation was repeated, with many modifications, with Josephine Zinkel.

368. But every other od-emitting object produced similar effects. When I slowly drew the point of a crystal of chrome, alum, arragonite, rock crystal, or heavy spar, over the surface of a magnetic layer of steel, the parts touched became much more strongly odically incandescent, to a diameter of two to four-fifths of an inch. Nay, even human hands were capable of producing this phenomenon. When I laid my right hand on the curvature of a horse-shoe, and moved it along toward the southward pole, a luminous patch was produced on all parts when I touched the iron, advancing along with my hand. The same occurred when I drew my left hand long the northward limb. The girl Zinkel was a frequent witness of this; but Wilhelmine Glaser, Dr. Nied, and Madame von Pischich-Zimanyi, also saw

these illuminations with full distinctness. Anka Hetmanek saw it on a steel magnet. When I placed a pocket horse-shoe magnet, which the beholders saw in strong odic incandescence at the poles alone, upon the flat hand of Miss Sophie Pauer, moreover of Miss Weigand, of Josephine Zinkel, of Wilhelmine Glaser, and of Madame Cæcilie Bauer, they saw the whole of the steel slowly increase in brightness, and in the course of a few minutes rise to a full odic incandescence. We shall hereafter meet with corresponding effects of the magnet upon other luminous bodies.

369. *Heat* did prove to me a means of aiding the odic luminous phenomena. I laid before Miss Sophie Pauer and Wilhelmine Glaser, small magnetic bars and horse-shoes, which they saw incandescent, and emitting flame well, while cold, and then placed these upon the heated stove in the dark chamber. When they had acquired about the heat of one's hand, both observers found that the incandescence had become much more cloudy and dull. Josephine Zinkel saw a large horse-shoe magnet gradually lose the brightness of its incandescence as it became warmer; and when I had heated it to about 167° Fahr., the odic incandescence had decreased considerably; but it was recovered as I let the armed horse-shoe cool. We know that magnetic intensity exhibits a similar course under like circumstances; therefore, the intensity of odic light, as it appears, is here parallel to magnetic intensity.

370. When I brought a steel magnet into the *electrical atmosphere* of the conductor of a machine, at a distance of forty inches, the length of the sparks being equal to two inches, the odic incandescence increased considerably in strength of light, even when it was not isolated, but merely held in the hand, or placed upon a table; and this was increased in proportion as the magnet was brought nearer to the conductor. Whether it at last became actually electrified itself, or not, its luminosity did not perceptibly alter further. This is according to a series of experiments which were made on Josephine Zinkel. They were gone through with short bars, with longer, and with one five feet long; then with smaller ones, as well as with a large nine-layer horse-shoe; and then with weak and strong electric charges.

371. It seems to me that the *influence which electricity exerts, and this merely by means of its atmosphere, upon the odic polarities*, deserves greater attention, so far as it is exhibited in the colors of their incandescence; when, for example, I turned the northward, negative, blue-glowing side of a magnet, no matter whether bar or horse-shoe, to the positively charged conductor, the intensity of the light was exhalted, the blue became brighter. When I turned the magnet

round, and directed the *southward*, positive, red, lighted side, to the positive conductor, not only did all the red quickly disappear, but it shortly turned into blue. *The odic polarities were reversed;* the + Od turned toward + E, was converted into — Od, and in correspondence with this the blue — Od of the distant side of the magnet was changed into red-glowing + Od. The Baroness von Augustin witnessed this in addition to Josephine Zinkel.

372. I reversed the experiments by electrifying the conductor negatively. It now acted in the reverse way upon the odic poles of the magnets. It changed the od-negative, blue-glowing pole, turned towards it, into a red-glowing; the od-positive pole, at that time turned away from it, into a blue-glowing, od-negative, all at the distance of forty inches. But so soon as I ceased to electrify the conductor, only a few seconds elapsed before the poles on both sides became pale, and returned into their original polar colors of odic incandescence, corresponding to the magnetic polarities of the bar. I could repeat this play of alternations at will, backwards and forwards, in a minute each time. Thus the power of electricity, by its mere atmosphere, and unisolated, was shown to strengthen considerably the odic polarities of magnets when placed conformably, and at once to reverse them temporarily when placed unconformably.

373. Since every one, who is at all acquainted with these branches of physics, is aware that the magnetic poles of a magnet are not subject to reversal under these circumstances, it will be almost unnecessary to detail the experiments which I undertook to attain the very fullest conviction, from facts, of the accuracy of this truth. Since the approximation of another needle could not be decisive here, inasmuch as it would itself become suspected of induction, I took another path. I appended a little bar to the further end of the twenty-inch long bar in such a way that, being attached to the outermost point, it could only just hold on, and fell off on the slightest shaking of the floor of the room. If the force by which it was held up had diminished in the least, it would, necessarily, have fallen off, long before this sunk down to nothing. Now this decrease, and final entry into a condition of indifference, must have occurred if there had been a reversal of the poles. I now charged the conductor and discharged it again; the odic incandescence of the rod was slowly changed now into the same direction as the electrical atmosphere; now into the direction of the original magnetism, repeatedly, but the little bar did not move, much less fall off. Thus the magnetic polarity of the bar did not undergo any perceptible change, while the odical polarity, as evinced by the colors of the incandescence of the poles, changed completely.

In these facts exist the strongest proof of the difference between

Od and magnetism, since they afford cases in which the two appear in diametrically opposed polarities in one and the same iron bar. More on this point will follow in the section on odic flame.

As the armature becomes incandescent by induction, it also becomes an *electro-magnet* by induction. I connected a soft iron horseshoe, the limbs thirteen inches long, and one inch and a half in diameter, wound round with a copper wire, four lines thick, with a little pile of six zinc and silver elements of Smee's battery, each having sixty square inches of surface. All the sensitives to whom I showed this in the dark, in particular Madame Kienesberger, Anka Hetmanck, Josephine Zinkel, Stephen Kollar, Madame von Tessedick, Professor Endlicher, Madame Josephine Fenzl, M. Delhez, &c., saw the iron, as well as the armature when I applied this, immediately become more or less odically incandescent. The open poles glowed most strongly, decreasing gradually downwards to the curvature. The color of the incandescence was bluish at the negative northward pole, reddish-yellow at the positive southward pole, exactly as in the steel magnet when acted on by rubbing. When the armature was applied, it exhibited contrary coloring, red at the northward pole of the magnet, blue at the southward; it had thus become an induced magnet by the induction of the other induced magnet.

375. And not only did the iron magnet thus produced become incandescent, but the other parts of the apparatus hereby thrown into the magnetic condition with it, namely, the copper coil, even the conducting wires, and finally the battery itself. I merely mention this here to make the Section on the odic incandescence complete. I must leave the detailed account of it until hereafter.

376. Even *an empty iron bar*, although independently constantly glowing weakly, as all bodies do more or less, is not insensible to the influence of difference of position toward the meridian on its odic incandescence. Josephine Zinkel saw an iron bar twenty inches long, which I brought to her in the meridian, increase in odic incandescence, becoming bluer toward the north and more reddish-yellow toward the south. When I now turned it round, the colors were reversed, so that the half turned toward the north always remained bluish. When I set it in the erect position, contrary to all expectation, she saw it, at the distance of a yard, a blue-grey incandescent above and whitish-red below. (These apparent anomalies will be discussed hereafter.)

377. We are already quite aware, from my earlier treatises, that the magnet possesses the capacity of imparting its indwelling odic force to other bodies. But that its power *to produce odic light* was at the same time *transferred to other bodies*, was first discovered by

subsequent researches. Madame Kienesberger, Miss Atzmannsdorfer, Wilhelmine Glaser, Zinkel, and Friedrich Weidlich, went through a variety of experiments, in which I brought on to flaring magnet poles iron and copper wires twisted together into flat coils, with one end projecting out about four inches. These wires immediately absorbed the odic flames, and themselves *at once acquired a greatly exalted odic incandescence.* Further on, (§ 485,) when giving the details respecting odic flame, I will give a circumstantial account of these experiments. Glass objects also, large lenses, the bells of an air-pump, acquired odic incandescence when placed upon the poles of strong magnets. (See § 481.)

878. If we now briefly sum up what has been stated concerning the odic incandescence, we obtain the following compressed *resumé*:—

a. The peculiar light, the odic incandescence, of all magnets, whatever shape it may possess, appears in the dark dull grey in the lowest degrees of luminosity; it then rises progressively towards whitish and yellowish, and generally assumes a bluish color at the northward pole, and a reddish at the southward.

b. This coloring is modified through a great number of shades, according as the poles of the magnet are open or closed, conformable or unconformable, turned to the east or to the west, upwards or downwards, *i. e.*, according to the different conditions under which its conflict with the terrestrial magnetism takes place. But it always follows a law which gives the rule of action in each position, and in every case makes good its influence.

c. An electro-magnet obeys the same law in all essential particulars.

d. A bundle of bars or horse-shoes which are placed with like poles together, becomes reversed internally into unlike odic poles.

e. The armature shares in this process; it acts passively and actively as an induced magnet, and modifies the phenomena of light and color.

f. An empty iron bar plays the part of a terrestrially induced magnet, and gives the corresponding phenomena of odic incandescence.

g. The intensities of odic incandescence keep pace with the magnetic intensities in one and the same magnet. They exhibit variations of magnitude among different magnets, and in each particular magnet itself, and this according to their position, as they are open or closed, or have the poles directed conformably or unconformably towards east or west, upwards or downwards. They change their positions on the poles and axes of magnets according to these circumstances. The light is strong enough to bear reflection from common mirrors.

h. Magnets closed with magnets instead of armatures have the lights of the odic incandescence displaced according to the same laws, but in a different way.

i. Wherever magnet poles are applied upon magnetic bars, they produce partial exaltation of the odic incandescence, spots of light. Crystals and hands do the same.

k. The electrical atmosphere causes exaltation of the odic incandescence.

l. It acts so strongly upon the odic light, that it is capable of producing a reversal of the odic poles where no change of the magnetic value occurs.

m. Heat weakens the phenomena of odic incandescence in steel magnets.

n. The odic incandescence is capable of being transferred from magnets to other non-magnetic bodies, copper wires, &c.

o. Although the odic intensities rise parallel with the magnetic, the values of the two do not; cases often occurred where + M appeared combined with — Od, or — M with + Od; and these contrasts strongly testify to the difference existing between them.

II. ODIC FLAME ON STEEL MAGNETS.

379. The odic flame which issues from magnets always keeps pace with the odic incandescence. It forms the second degree in the scale of strength of the odic luminous phenomena, and consists of a brightness which the weaker sensitives only see as a luminous halo over the poles of the magnets, but which, to those more highly sensitive, assumes progressively more of the external aspect of a real flame, in proportion to their power of vision, and is described by them as such. There are incandescent magnets without visible flame, but no odic flames without visible incandescence. The incandescence is always the first appearance of light. I had once a horse-shoe magnet which had become so weak that it would no longer support its armature, although it was still perceptibly magnetic. I showed it to Josephine Zinkel in the darkened chamber, at a period when her power of vision had a high degree of sensibility. She saw the whole mass of steel lighted with odic incandescence, but could distinguish no flame at the poles, only a little smoke. When the odic intensity was increased, the flame became visible. It exists, as we are justified in assuming, *everywhere;* but we can only speak of it where it becomes visible. We will follow its appearances, so far as I

have been able hitherto to make out its traces, beyond what has already been told, by running through the series of experiments upon magnets which I instituted for this purpose.

380. We have in the first place to take up the thread of the details given in the first of these treatises, from § 3 to § 20, to which I refer the reader. A year later, namely in 1845, I went through a series of investigations with Miss Reichel, while she was residing with me, which served both to confirm what was before stated, and to unfold new matter which must be appended to the former. She saw all magnets, without exception, furnished with flames of different size and intensity of light; the former according to the different sizes of the magnets, the latter according as they possessed different strength of magnetic or odic charge, as well as proportioned to her power of sensitive vision, more exalted or more depressed by fluctuations of her disease. I shall here select only a few out of hundreds of experiments. Late in the summer, when she is usually somewhat better in health, she saw a weak bar, twenty inches long, with a flame rather more than one inch long. At the same time she saw a seven-layered horse-shoe with a flame of eight inches at its poles. At a subsequent period, during more highly excited sensitiveness, the largest of my steel magnets, a heavy horse-shoe, made of nine cast steel layers, was placed before her in the dark. This time, as in the year before, although she did not know of the magnet, she saw flames six feet high blaze up from both poles. They were so vast, that, as the horse-shoe had the poles turned upwards, the flames blended together, as they rose, into one column of fire. With regard to the different colors which were given out along each pole, she perceived that the column of light was composed of two trunks, one yellowish-white, the other bluish; the first smaller, the second larger. The entire chamber was so strongly lighted by it that she could detect the outlines of every object. All the space between the white odically incandescent limbs was full of streaks of flame, and the outside of the steel was enveloped in a luminous mist, which seemed to flow onward in waves, sometimes towards one pole, sometimes towards the other. At the ends of the layers, their edges and corners, where they formed the polar ends, special little flames streamed out sideways, strongest from the outer angles, when they finally terminated in isolated spreading sparks. Since all this agrees exactly in every particular with what Miss Reichel had described a year before, on a smaller scale, of a weaker magnet, I showed to Miss Atzmannsdorfer, after her observations and the descriptions were completed, the drawings which are appended to the first part of this work. She found all to agree pretty exactly with what she herself

had seen, and thus confirmed the accuracy of my earlier researches. She added only, in connection, that the flame-like phenomena were in reality all much more delicate and lighter than those represented in the drawing,—but at the same time moving about, uniting together, and intermingling with varying colors with every breath of air.

381. I have to state in almost the same words from a healthy patient, the girl Zinkel, what I have just communicated from a diseased sensitive. She also saw more distinctly, under certain circumstances, the odic flame flow from half an inch to four inches from bar magnets, and blaze from three to five feet high from the nine-layer magnet; among these circumstances was the occurrence of the catamenia. She then detected also the little lateral flames on the edges and corners of the bars, as well as of horse-shoes, the play of colors, the great illumination, the scattered sparks, all nearly word for word as Miss Reichel had described it two years previously.

It has already been mentioned, (§ 316,) that the healthy Baron von Oberländer saw the odic flame as large over the nine-layer horse-shoe magnet. The same was said of Friedrich Weidlich,—(§ 330,) as well as at § 328 of Madame Kienesberger, at § 313 of the healthy sensitive Wilhelmine Glaser, § 315 of Dr. Nied, § 312 of the Baroness von Augustin, § 303 of M. Franz Vernolendt, § 299 of Madame von Varaday, and only a little less strongly, § 309 of the thoroughly healthy Miss Sophie Pauer. *All these persons saw flames blaze up to the height of a man over the nine layer horse-shoe magnet.*

382. Let us now examine some of the properties of the odic flames of the magnet; in the first place, *their extent.*

We have seen that the *size of the flames* depends objectively on the size of the magnet and its magnetic intensity or strength of change; and that the perception and recognition of it is also subjectively conditioned by the excitability of the observer. As there exist among mankind, in respect to common sight, such great differences, that one man does not recognise his brother passing by him, while the eagle eye of another enables him to count the sky-larks in the air; as, moreover, there are some who cannot see at all in moderate darkness, while others can see their way in the darkest night; as, in more striking cases, those suffering from hemiralgia can only see in the strongest light, and are quite blind in a dim light, thus directly opposed to the sensitive; as there are albinos, and indeed such as cannot see colors, and to whom the world looks like a copper-plate engraving;—so is it also with the power of seeing odic phenomena; in proportion to their power of vision, the odic flames of one and the same magnet appear more extensive or more limited; and this is not merely different in different individuals, but varies in one and the same on different days, at different hours, nay even most surprisingly from minute to minute, so that at three rapidly succeeding moments one and the same odic flame may be imperceptible, immediately afterwards visible, though small, and then, directly after this, large and expanded, without any change in the object, by mere change of the susceptibility of the observer. The cause of this will be made known circumstantially in the succeeding treatises, when we come to speak specially of the power of odic vision.

383. The perception of a sudden and rapidly vanishing flash of light, when the *armature is pulled off the horse-shoe* quickly, constitutes the lowest degree of recognition of the odic flame upon magnets. This was seen by Dr. Nied, Baroness Pauline von Natorp, M. Kotschy, Madame von Varady, M. von Rainer; Baroness von Peichich, M. Amalie Kreüger, Wilhelmine Glaser, M. Ernst Pauer, Prof. Endlicher, M. Delhez, Baroness von Augustin, as well as Miss Nowotny, (§ 3.) Madame Cæcilie Bauer gave a more accurate account of this process. At the moment when the armature was pulled off, she saw a sparkling flash of light, almost like that produced by flint and steel, disappearing instantaneously. The flame over the poles of the horse-shoe was not largest then; on the contrary, smallest, and at the first moment almost imperceptible. Immediately on this it began to form, at first small, then increasing, and soon rising to its permanent magnitude. About a minute was required for this. Some months later, I received exactly the same description of this phenomenon from Josephine Zinkel.

The different degrees of strength of the light from a mere halo to distinct flames, presented by the luminosity appearing at the poles of magnets, were described a little differently by almost every observer. We found MM. Hütter and Schuh, and Prof. Ragsky, at the bottom of the scale. Next to them stands Prof. Husz of Stockholm, who only saw the light over the electro-magnet. In the middle degree occurred the observation of Prof. Endlicher, among others, to whom the luminous emanations exhibited more general distribution and great substantiality; then the physician Dr. Nied, M. Rabe, Baroness von Augustin, Miss Sophie Pauer, Baron Oberländer, Anka Hitmanck, and the painter M. Anschütz. Above these stood Mad. Cæcilie Bauer and Josephine Zinkel, and at the top of the series the somnambulist sensitives, to whom the lights over magnets always appeared as distinct flames.

384. Among the objecting conditions of the *magnitude of the odic*

flame, is the distinction between the northward and southward poles of the magnet. The two flames are in most cases of different size: at least in the 48° of N. lat., in which my residence lies, when the horse-shoe stands upright, or when thin poles are turned toward the north, or when bars lie conformably in the meridian. It must be relatively different in other places. Under the tropics, the distinction in the conformably placed magnets will become imperceptible, and, in the magnetic equator, disappear altogether. On the other side of the tropics, *e. g.* at the Cape, at Van Diemen's Land, or in Buenos Ayres, these conditions will be reversed; the flames of the southward pole will have the upper hand in those cases where the northward pole prevails with us. When a bar magnet lies in the meridian, the northward pole turned toward the north, all my sensitives, sick or healthy, have, in innumerable experiments, found the flames of the northward pole larger than those of the southward pole directed to the south. Taking the mean of all the accounts, the difference amounted to about one-half, so that the northward flame was about double the length of the southward. I say, about; for the innumerable questions I put could not be answered in the dark according to a regular standard; in most cases they used the assistance of the span, and explained themselves by such terms as hand's length, hand's breadth, thickness of one's thumb, &c. And there is no occasion for great accuracy here, where, for the present, we are only seeking the general outlines of the phenomena. It is sufficient to say that the concordant testimony of all the sensitives gives the relation of magnitude of the northward flame to the southward as 2 to 1. This is in inverse proportion to the magnitude of the odic incandescence of bars, since in these the blue northward side is shorter than the red southward. (Still the latter may easily depend upon some deception; for the blue odic incandescence is much less luminous than the yellowish-red, and thus in the lower degrees becomes invisible to the eyes sooner, without being really shorter.) To support this by the testimony of experiments, it would be necessary to call over again almost all the persons named, which would cause useless diffuseness. I confine myself, therefore, to mentioning the healthy Dr. Nied and Baron von Oberländer, Madame von Varady, Madame von Peichich, Prof. Endlicher, M. Constantin Delhez, Baroness von Augustin, Miss Sophia Pauer, also Madame Kienesberger, Misses Atzmannsdorfer, Reichel, Weigand, Winter, and in particular the healthy and strong Josephine Zinkel, and the healthy Klaiba the joiner, on which latter I have repeated this experiment especially often.

385. The result is modified, though similar, when a *magnetic bar*

lies not in the normal direction in the meridian, not conformably, but is placed in such a position that its northward pole is turned toward the south and its southward pole to the north; that is, unconformably. In this case the sensitives observe a diminution of the odic flames; they both become of duller aspect, less luminous, more dim, shorter and narrower, and moreover modified in color. This is, on the one hand, deducible from the general theory of magnetism, and has also been observed in numerous experiments with Madame Kienesberger, Misses Atzmannsdorfer, Wilhelmine Glaser, Reichel, Winter, and Josephine Zinkel.

386. To these sensitives a *horse-shoe* was submitted in the same way, while lying horizontally in the meridian, as described above, (§ 338,) that is to say, once with both poles turned to the north, another times with both toward the south. In the first position the northward flame appeared larger and more brilliant, while that of the south pole seemed diminished, of a dirty almost bluish red; in the second case the northward flame appeared dim, greyish-blue, with a tinge of yellowish, and diminished about one-third; while, on the contrary, the red was enlarged about half, enlivened and brilliantly red luminous.

387. When I placed an open five-layer horse-shoe magnet vertically, the poles turned upwards, and the limbs conformably,—namely, in such a manner that the northward polar limb stood on the north side, and the southward polar limb on the south side—the flames of both poles appeared to Josephine Zinkel vivified, large, and brilliant; when I placed the limbs unconformably,—the northward polar limb on the south side, and the southward polar limb on the north side,—both flames were dull, diminished, dim, and discolored.

388. When I turned a horse-shoe the other way upwards, in the same vertical direction, so that the poles were directed downward, suspending it by the curvature to a copper rod, and thus keeping it in the conformable position, the flames of the northward pole were shorter, those of the southward longer.

When I gave both poles the oblique direction of the magnetic inclination, the conditions were about the same.

389. Transverse positions of all kinds, where the poles were placed east and west, gave intermediate conditions with numerous modifications, in which, however, the relative sizes of the two poles exhibited less difference. And this in the following manner.

390. When the two poles of a horse-shoe lay to the west, the same observer described both flames as short; when in the reverse position, with both poles toward the east, they were somewhat longer. But

both parallel positions always possessed shorter flames than the vertical with the poles turned upwards.

391. The further observation comes under examination, that the flames appeared :—

At the northward pole,	in the eastward	direction,	longer but duller.
" "	in the westward	"	broader but more luminous.
At the southward pole,	in the eastward	"	broader but more luminous.
" "	in the westward	"	longer but duller.

We shall see hereafter (§ 405, where we shall speak of the conflict between two odic flames,) what the conditions are of these distinctions of longer and broader, and then find the proof that the former belongs to an attraction, the latter to a repulsion of the odic flames; and we may take this opportunity of anticipating the important discovery, which must be discussed more circumstantially elsewhere, that the *east stands in some degree on the side of the north, the west on that of the south, in their relations to* Od, vide § 536.

392. In like manner I tested, by numerous experiments on the highly sensitive, the influence which the *magnetic inclination must* necessarily have upon the character and size of the odic flames depending upon the steel magnet. Misses Atzmannsdorfer and Reichel, Madame Kienesberger, and the healthy sensitive Josephine Zinkel, took the greatest share in these. It was first seen that the experiments which I described in the first treatise, (§ 11,) were not unconditionally but only conditionally correct. There, namely, I stated on the authority of Miss Reichel that the terrestrial magnetism does not appear to exert any important influence upon the size of the odic flame. This statement is correct, when, as happened in that experiment, the change of poles and inclinations is *effected rather quickly, and no time is allowed for the development of the polar flames.* At that time I was unaware of a certain degree of slowness with which nature effects the odic operations, for the full completion of which some little time—a half, a whole, or in many cases several minutes, are required: on which point I shall hereafter find an opportunity to say more. When the experiments of § 11 were made with greater slowness, and subjected to examination, it was certainly seen that the odic flames altered, not only in size but even in form, according as the position assumed was larger or smaller, and that the terrestrial magnetism did certainly exert an influence upon it, which, though slowly, was most decisively and considerably manifested. The suspended magnetic needle, as is well known, changes its position instantaneously whenever the terrestrial magnetism can exert influence

on it; and this influence shows its effect at once in its whole force. I was formerly led away by this usual manner of looking at it, but longer experience has taught me another in reference to odic effects, which only rise slowly to their maximum. When I subsequently modified the experiments with Miss Reichel in such a way that I no longer held the bar magnet in my hand, whereby the polar flames were complicated and rendered untrue, but fixed it in a wooden Guidoni's holder, and then brought it into the magnetic inclination, in which I let it remain a minute, I expected that the blue north polar flame would increase in size, strength of light, and in color, and that the northern reaction which I had been previously acquainted with would necessarily increase in intensity of every kind. But the result did not in the slightest degree confirm my preconceived opinion. On the direct contrary, the beholder of the phenomena told me that the flame of the northward pole had acquired the very reverse color, and decreased considerably in strength of light. The blue color became dull, opaque, grey, and dwindled away till it was imperceptible. When I turned the steel round, and brought its northward pole into the opposite direction, in the inclination, seen at the *distance of a yard* and more, the flame appeared bluish, large, and vivid. The same experiment, made at a different time, with Miss Atzmannsdorfer, furnished the same unexpected result; not only did not the northward flame increase in the inclination, but it disappeared in great part from her eyes: but when the steel was reversed the sensitive saw the bluish flame again of almost double size. Finally, I tested these most strange and striking results with the greatest exactness, in Josephine Zinkel, and devoted many days to a thorough investigation of them with her in the dark. Here also my experiments had the same result: in the inclination, where it might have been expected that the flame of the north pole would appear at its maximum, it on the contrary sank down into a sort of minimum; instead of rising to the most vivid blue, it lost all color, and remained nothing but a dim grey. We shall see hereafter that these astonishing visual phenomena were perceived and confirmed in like manner through corresponding phenomena of sensation, by all the sensitives, even when of much lower degree of excitability. Since, then, this appears to be directly opposed to the attraction of terrestrial magnetism, by which, in our hemisphere, the negative pole of the needle, brought down to the direction of the inclination, is attracted, not repulsed, by the positive north pole of the earth, we see from this, as distinctly as from the preceding experiments, that the odic flame, or the odic phenomena in general, are indeed influenced by the magnetic attraction, but by no means unconditionally governed by it, and that the *globe contains* *other qualities acting upon Od and its characters besides magnetism.* I shall bring forward all that I have been able hitherto to make out on this subject in the details in the odic colors, § 489, &c.; here, where we have merely to do with the effects of magnetism on the odic flame of the needle in the direction of the inclination, I am contented to announce the results.

393. When I applied horse-shoe magnets to these experiments the case was somewhat modified. If the two poles were turned toward the north, the blue flame of the northward pole appeared in its full length; but the reddish flame of the southward pole seemed repressed, bedimmed, bluish-red, and diminished in size. On the other hand, when the poles were turned toward the south, the red flame of the southward pole was enlarged; while that of the northward pole became duller, reddish-blue, and diminished in size. When the two poles stood directed upwards, the northward pole was strengthened, the southward pole lessened (thus giving a new support to what was stated in the last paragraphs.) Nay, this went so far that it afforded a circumstance worthy of notice in a practical point of view—namely, this, that the odic flame of the unconformably placed pole was not unfrequently wholly repressed; that is, became no longer perceptible to the eyes of particular observers, and thus made it appear as if only one pole possessed an odic flame. My note-books swarm with indications of this case, and there was scarcely one of my numerous sensitives to whom it did not frequently occur under the proper circumstances, especially those of weaker power of sight, or in imperfect darkness, or when the observing person had not remained long enough in the dark. As witnesses, I mention the Baroness Natorp, Miss Dorfer, Madame von Tessedick, Madame Fenzl, Miss Sophie Pauer, MM. Hochstetter, Fernolendt, and the chlorotic Hetmanek.

394. There was a difference produced in the size of the odic flame, whether a magnet stood free with the poles in the air, or lay flat upon a table. In the latter case, all the observers perceived the flames observably larger, sometimes expanded to twice the size. Wilhelmine Glaser saw the flames of both the poles of a bar become as long again upon a table of polished walnut wood. Miss Sophie Pauer looked at magnets upon an unpolished deal table; they formed a long stream of light flowing in waves upon it, at the southward pole shorter, thicker, and red; at the northward, long, slender, and blue. The waving motion could be seen most distinctly in profile; when seen from above, it enveloped the poles like a halo, which also rose up in the air immediately above them. Madame Cæcilie Bauer and Josephine Zinkel, especially the latter, were frequent witnesses of this

phenomenon, according to which it appears as if the table formed a kind of fixed point whence the odic flame flowed forth.

395. The results remained the same whether I applied the largest, the middle-sized, or the smallest magnets, even such as might be hidden between two fingers. The phenomena were, indeed, on a proportionately smaller scale, but remained exactly the same in kind. Thus, immense masses are quite unnecessary here, for very much can be done with small instruments, and with these the greater part of my observations may be repeated and confirmed on a small scale. *A small magnet charged to saturation appears to possess as much odic tension as one out of all proportion larger.* The luminous phenomena occur in a more limited space, but the effects remain qualitatively the same.

396. The same phenomena of which I have already given an account at § 340, &c., when speaking of the odic incandescence, and to which I must refer for the sake of brevity, namely, the *banded colorings*, occur also with the odic flame on compound bar and horse-shoe magnets. The middle layer of a nine-fold horse-shoe magnet emitted blue flames at the negative pole; the pair next to it in front and behind, gave out red; the second pair blue again, the third red, and the fourth and outermost blue. The red flames of the two enclosed red layers were here somewhat repressed, especially when placed with the northward side toward the north. All these phenomena were repeated with the reversed arrangement of colors at the southward pole; and here the two enclosed blue layers had repressed flames which looked rather grey than blue. Looking sideways, the flame had a banded red and blue appearance for a short space just above the steel plates. Yet this could not be traced far up beyond the poles with any distinctness, for the colors soon became intermingled and lost in the general stronger color of the predominant pole, so that at the negative pole the red flame which issued from the magnetically reversed layers was lost at a little distance on the predominant blue, and *vice versâ.* Only the red and blue streaks and sparks ascending in them, of which I shall soon (§ 454) have to speak, retained their colors.

397. The phenomenon here described also includes in itself that which is described in § 9, and illustrated by Fig. 9, but which was less circumstantially related by Miss Reichel than in this case by Josephine Zinkel. The latter also saw, from the side, the flame-like streaks ascending from each separate layer; but she found the interspaces between them not empty, but also filled with odic flame, only of paler luminosity. Miss Reichel's observations were made in an improvised much less perfectly darkened chamber than those of Jo-

sephine Zinkel; I subsequently had a perfectly dark chamber prepared. The former, therefore, saw only the more luminous streaks, and the less luminous interspaces appeared to her void; the latter found the entire space above the poles of the nine-layered magnet flaming, with brighter flames from the edges of the layers, which were prolonged upwards, clearly distinguishable through the bundle of flame. The banded appearance of the magnet-flame at the side was thereby still more increased.

398. The *intensity of light* of the odic flame varies extremely, and runs from a weakness in which it appears as but a vapor, even to the highly sensitive, to a bright, and finally to so brilliant a flame, that it was often wholly incomprehensible to them why I could not also see it. At the same time, it never attained to such an intensity that I was enabled to perceive the slightest trace of it, which certainly could not have been from want of attention in my frequent and long-enduring sojourns in the dark. When the flame was gently blown upon, especially in the direction of its flow, the intensity of the light increased, in particular at the places which were acted on. This was witnessed by Josephine Zinkel, Wilhelmine Glaser, Miss Sophie Pauer, Prof. Endlicher, M. Hochstetter, M. Delhez, and Baroness von Augustin, on bars, horse-shoes, and electro-magnets of various forms. More will be said of this below, at § 409.

399. The *agitation and constant motion* which prevail in the odic flames of the magnet, were confirmed in many new experiments by Miss Atzmannsdorfer, Josephine Zinkel, Madame Kienesberger, Weigand, Dorfer, Friedrich Weidlich, the healthy M. Nikolas Rabe, Baron Oberländer, Miss Sophie Pauer, Madame von Peichich, Baroness von Natorp, Madame von Varady, Madame von Tessedik, Prof. Endlicher, M. Delhez, Baroness von Augustin, Dr. Nied, Johann Kynast, Klaiber, and others. The first and last compared it in some degree to the positive brush from the points of an electric machine, only they described it as much more delicate, fuller, the northward flame bluer, but in like manner mobile and flickering, cool, weakly luminous, sometimes almost of a beaded appearance. It partook of every little agitation of the air in which it was.

400. I often made the *direction* which the flame took the object of investigation with the sensitives. In place of a number of their statements, I will confine myself to two examples, which include in themselves all the rest. I placed a nine-layer horse-shoe upon a stool before Miss Atzmannsdorfer, with the poles turned toward the south. She saw the odic flame flow out of this to about an arm's length, in the dark. It first shot out some distance horizontally in the direction of the limb of the magnet, then rose in a curve upwards and

formed a quadrant, so that it at length flowed vertically upwards at its point. The same observation was made by Josephine Zinkel on flames of horse-shoes and bars. Thus, the odic flame is sent out from the poles of the magnet with a certain force, an impetus is communicated to it, which drives it forth from the poles; but, on the other hand, a tendency is implanted in it to ascend in the air, and its material basis is consequently evidently lighter than atmospheric air at the earth's surface. From the composition of these two forces there results the ascending quadrant curve of the odic flame. This experiment, however, is only to be accomplished with very strong magnets, the flames of which have considerable length; otherwise, in short flames, all observers see the polar flames only in the straight direction, forming a prolongation of the limb of the magnet. From the multiplicity of directions toward the various points of the compass which may be given to the magnet, and the various inclinations toward the horizon into which it may be brought, result complex enlargements and diminutions of the odic flame, according as these directions are conformable or unconformable to the normal position.

401. I here note a series of experiments with several sensitives, for the purpose of investigating the reciprocal effect which different magnetic odic flames could exert upon each other when brought in contact. This might afford further conclusions respecting the relations of magnetism to the odic flame. We regard positive and negative magnetism as endowed with an active tendency to attract each other, and then by a mutual confluence to neutralize one another. But when we consider the curved ascent mentioned in the last paragraph, and place in the scale the phenomena of the odic flame related in § 392, where it occurred unconformably to the inclination, it seems that no such reciprocal attraction dwells in the odic flames; we meet with distinctions between the two in their special manifestations. To the valetudinarian Miss von Weigelsberg, Miss Winter, and Madame Johanne Anschütz; also to her healthy relatives, Miss Ernestine and M. Gustav. Anschütz, M. Delhez, Madame Josephine Fenzl, Madame von Peichich, M. Hochstetter, Dr. Nied, and the Baroness von Augustin, I exhibited two magnetic bars in the darkened chamber, each four inches long, holding them in the magnetic parallel horizontally, with the unlike poles held toward each other, at the distance of twice the length of the bars apart. At the same time I observed the indispensable precaution of holding the bars in such a manner that my right hand enclosed a southward pole, while the north pole belonging to it projected out; on the other side a northward pole was enclosed in my left hand, while the south pole

belonging to it was outward, the reason of which will shortly be evident. All these witnesses saw the originally small odic flames of both bars become more slender, and increase in length, as soon as the bars were brought near together in the above direction, as if they were striving to reach one-another. When I brought the bars really nearer together, the flames went back to their original shorter, thicker size, which increased still more and more the nearer I approximated the poles. The intensity of the light increased at the same time. When I joined the magnetically attracting poles, both flames in great part disappeared, but they immediately became stronger on the opposite poles, and now attained double the size that they had before. Dr. Nied and M. Hochstetter added, that the thickness of the odic flames much exceeded that of the steel when the poles came near, and that their brightness was greatest when the ends of the bars were closest together. Miss Reichel saw these phenomena better and more distinctly. In 1844, I placed two little magnetic bars, of almost equal length, in her hands, led her into the dark, and made her hold the unlike poles of both bars in a straight line, bringing them from a distance nearer together. Even at the distance of three times their length, she saw the flames between the poles pointing to one another, acquire a greater size than those of the two outer poles turned away; they became narrower, longer, thinner, and stretched out toward each other, as if trying to reach one another. On her then bringing the magnets nearer together, these inner flames increased in size at the expense of the outer, and just in proportion to the approximation. *But when, by the increasing approximation, the flames at length met, they did not neutralize one another;* they increased in thickness while they lost length by the approach of the poles emitting them. At the opposite external poles they shrank up to a very weak and dull flame. Finally, when the friendly poles became joined, the middle flame was almost entirely extinguished, but at the outer pole of each bar there immediately arose an odic flame far larger than had existed on either of the separate bars: the two bars were now converted into a single one twice as large, and this emitted flames twice as long from both poles. Thus the odic flame increased in equal measure with the growing strength of the magnetism, both in the approaching poles, and, after their union, in those turned away. Prof. Endlicher saw the flames of both bars, when held at some distance apart, increase rather in length, but on approximation to within two-fifths of an inch contract into a disk around their poles; then, on actual contact of the poles, disappear. M. Pauer observed the same experiment. He saw the two polar flames when I had brought the poles within two inches of each other. They increased in size up to the contact of the poles. Then the light sank considerably in intensity,—not, however, disappearing entirely; but the two touching steel poles now appeared enclosed in vaporous halos of light, each about four-fifths of an inch long. Madame von Varaday observed the same. Wilhelmine Glaser perceived the same phenomena, and added to the account, that she saw the thickening and mutual repression of the polar flames increase so much just before the actual contact of the two magnet poles, that she perceived a partial introversion of the magnetic flames. This description of the process was made still more complete by the experiments which I made in this direction, in 1845, on Misses Sophia Pauer and Atzmannsdorfer, and in 1846 with Madame Kienesberger and Friedrick Wiegand. In each case I used the same small magnetic bars, and carried out the experiments in the darkened chamber, the beholder sitting with the back to the north, holding the bars horizontally in the magnetic parallel. The phenomena presented themselves all in the same order, and of the same kind as above given; first, at a distance, elongation and attenuation of the approximated odic flames, as though they were exerting an active endeavor to reach one another. But this meeting did not come to pass when the flames came near enough, for a return to the original shape now occurred: with the increasing approximation, this thickness became greater and greater at the cost of the continually diminishing length, and when the flames should actually have met, they were so far from exhibiting any desire to join, that they exerted mutual repulsion, drove one another back, and became continually shorter and more repressed. They behaved as if seized with a mutual fear, became accumulated around their own poles, like the flame of a candle blown upon gently from above; and when, at the distance of only a few lines apart, each flame formed a kind of broad flattened coil around its pole, distinctly repulsed by the odic flame standing opposite to, and pressing upon it. This repression went so far that, when only two twenty-fifths of an inch interspace existed between the poles of the two bars, both flames appeared *thrown backwards* upon their own poles, and, to a certain extent, introverted around it. This took place in particular sooner with the flames of the corners than with the flames of the middle of the ends of the poles, which were compressed into a sort of disk around the poles, at length applied one upon the other. When the poles came at length into contact, and became attached, this state of things continued for two or three seconds, decreasing in such a manner that the curved flames appeared to become gradually shorter until they were extinguished. But this extinction was not actual, being only a decrease of intensity of the light of the odic flames: careful observers, M. Pauer, like his daughter Sophie, and Madame Kienesberger, detected its persistence in a weaker condition, enveloping the joined magnet poles. In the meanwhile the flames of the two opposite ends of the bars became so much the stronger, and doubled their size.

402. I used magnetic bars twice the length with Madame Cæcilie Bauer. She saw the positive red pole and the negative blue pole flaming beautifully, the former two, the latter four inches long. As I brought the friendly poles of the rods nearer together, with the hands properly selected, in the parallels, the flames stretched out toward each other, became thickened and expanded as I approached them nearer, then were introverted in some degree around their poles, and, when I had completed the union, the introversion vanished, and was succeeded by envelopment of the poles lying against each other in the opposed odic flames.

403. When, however, the *similar, thus hostile poles, were approximated in the same way in the dark*, especially the two negative, the original elongation and attenuation did not occur; but, where the poles came near together, the flames, if the magnets were strong, were drawn back, and finally introverted around their own poles in the same way as with the unlike poles. But if they were of unequal strength, the stronger flame of the larger magnet drove back the weaker one of the smaller sooner, heaped it up against its pole, when it expanded in the form of a disk or little wheel, the plane of which was at right angles to the axis of the magnet. One of the beholders, Miss Atzmannsdorfer, compared this phenomenon also, among other things, with the experiment of blowing down upon the flame of a candle, so as to drive it down upon its wick, where it is also compelled to expand sideways by the current of air opposing the draught of the flame.

404. These experiments were carried through the most varied modifications with the healthy Madame Cæcilie Bauer and Josephine Zinkel, and the results are shown most clearly here. In the first experiments with the latter, when her power of vision was not particularly strong, she did not perceive any distinct flame on the little magnetic bars in the dark, but only a luminous mist or smoke. But these went through the same course as the others had seen the flames do; elongation of the smoke at a distance, with apparent endeavor to reach and blend with one another, non-effectuation of this when sufficiently close but expansive in thickness, then repression and division through introversion around their own poles; finally, on contact of the poles of the magnets, a slow disappearance of the luminous smoke and a doubling of it at the opposite free poles. In another

experiment I made use of the epoch of her menstruation, when she saw incomparably better in the dark, and I applied two small magnetic bars, one of which was rather larger and stronger than the other. The arrangement was the same as in the preceding cases. I extract the passages relating to this from my journal: "Zinkel, experiment No. 453.—*a.* The two southward poles approximated, the flame of the smaller bar disappeared almost entirely from her perception; that on the larger became weaker, and what remained was introverted around its pole. *b.* The two northward poles approximated, both became introverted. *c.* Friendly poles approximated, the northward pole of the larger bar being brought to the southward pole of the smaller; the flame of the smaller southward pole was extinguished, that of the larger northward pole weakened and introverted. *d.* The same, only the northward pole of the smaller bar approximated to the southward pole of the larger; both flames extinguished on contact of the poles. Thus the stronger pole always overcame the weaker, and the remnant of odic flame became introverted. But the southward pole is always weaker in proportion than the northward." In these experiments the weakly luminous envelope, or flame remaining, escaped observation.

404. B. In some later experiments with her the phenomena were more distinct; and in one the results accorded exactly with Madame Bauer. With bars eight inches long—

a. Similar poles first mutually repelled the odic flames, but on contact of the steel both were totally extinguished.

b. Unlike poles at first attracted each other at a distance, their flames becoming elongated, but on approximation they were contracted, thickened, and at length so much so that the introversion on both sides followed.

c. When the contact of the poles of the magnets was completed the introversion disappeared, and the odic flames of the two opposite poles became perfectly immersed in each other.

d. This immersion was much deeper than the introversion, indeed five or six times as deep. An introversion of 1-25th of an inch in depth was followed, on contact of the steel, by an immersion, in which the blue was one-fifth of an inch long, the red shorter, but more than half the length.

e. The intensity of light of the luminous envelope producing the immersion was so strong that the odic incandescence of the bars could not be seen through it; the observers saw nothing of the steel bars at the part where they were encircled by the envelope of flame, and first perceived their ends again when they were drawn out of it; this surrounded them as a dense luminous cloud, involving the bar to such an extent as to render it invisible.

f. So long as I made the experiments in the parallels, the girl Zinkel perceived the introversion of the red flame only; that of the blue she was uncertain of. But when I brought the bars into the meridian, conformably, the intensity of the light was exalted, and the blue flame also now became visible.

g. Approximation of the poles of smaller magnetic bars, of four inches length but of greater magnetic intensity, brought together in the parallels with unlike poles, gave proportionately greater enlargement in space of the blue polar flame than of the red; on the other hand, the red polar flame acquired greater intensity of light than the blue. Thus the light did not increase to any great extent in the one, nor did the size in the other.

405. I also traced this subject with *horse-shoe magnets* on various sensitives. M. Hochstetter observed, in the darkened chamber, the gradual approximation of a three and a five-layered horse-shoe. At some distance he perceived the elongated; when they came near, the abbreviated, repulsed, thickened flames, much thicker than the limb itself of the magnet; when the poles were joined, the flames vanished from his sight, which had only a moderate degree of sensibility to odic light. With Miss Sophie Pauer all these observations were repeated with greater clearness and more circumstantiality; she saw the odic flames introverted around the poles, become converted, on the union of these, into an envelope of the intermingled flames of the adjoining poles. I went most carefully to work with Josephine Zinkel. I laid two five-layer magnets upon a table, in the meridian, the four unlike poles directed toward each other. I will here give a full account of the whole process, in all its parts, for the sake of summing up the results.

a. At a distance of two feet between the poles, the beholder saw the northward poles of both magnets in a blue, the southward in a red light; those lying conformably clearer than the unconformable, and the limbs odically incandescent as well as flaming; the blue negative emitted horizontal streams almost eight inches long over the table; the red positive about six inches long. *b.* The flames of the two magnets did not meet at first; in the interspace between them she saw a luminous smoke rising up to a height of about two inches, and then vanishing. *c.* A light was diffused some distance round upon the table, some twelve or sixteen inches on every side, and the luminosity rose upwards above the table, so that the poles of the horse-shoe appeared to be surrounded with a glory. *d.* The limbs were wholly covered with luminous flame as far as the curvatures;

reddish upon the southward limbs; bluish on the northward. *e.* When the poles were moved far enough apart, the unilluminated interspace appeared grey in the dark; but when the smoke of the two horse-shoes met, a transverse bright streak, produced by this, became visible upon the table. *f.* When I moved both horse-shoes to a distance of sixteen inches, the lights of the two streams of flame met upon the surface of the table; the now united smokes ascended a hand's breadth and a span high. *g.* Brought to twelve inches distance, the opposite flames met, acted upon each other, and began to grow thicker. *h.* Approximated to eight inches, the flames came more strongly together, rose up more from the table, on account of becoming thicker, to a height of about two inches and a half, and luminous smoke ascended six inches high over them. *i.* On approximation to four inches, the odic flames grew thicker and rose continually higher above the table, especially that of the northward pole; the smoke went on increasing in height. *k.* At an approximation of two inches, the phenomenon of introversion of the odic flames around their own poles presented itself, and in such a manner that it was repulsed and introverted about two inches on the north side. The smoke now *no longer ascended in front of the poles, but behind them,* directed upward towards the curvature. *l.* When brought to a distance of four-fifths of an inch, the introversion became so great, that the inverted flame of each pole passed back over the limb from which it issued beyond the curvature, to a distance of not less than full four inches. The smoke now rose from both horse-shoes far behind the curvatures, and indeed did not begin to ascend at a less distance than four inches from it. *m.* Finally, on actual contact of all four magnet-poles, all these introversions suddenly vanished, and a complete immersion of the opposite polar flames succeeded: the mixed flame presented itself. This extended almost to the opposite curvatures, and so veiled the limbs that they could only be seen with difficulty. The blue limbs, which just before were in blue introverted flames, were now suddenly deserted by them, and enveloped in red mixed flames, while the red limbs became enclosed in blue mixed flame: thus all four changed their colors in a moment. The curvatures of the horse-shoes at the same time seemed to become more brightly incandescent, and the beholder again compared them to a white translucent jelly. The smoke had then disappeared, and was nowhere to be seen in profile.

I shall return to several of these particular phenomena, (which have been touched upon, in part, under the head of odic incandescence,) where they necessarily come into their own sections: they are not separated from each other here, as I wished to give a general view of this experiment.

406. When the united poles of the magnets were separated again, the somewhat strange observation was made, that the mixed flames did not disappear immediately. As I parted the horse-shoes again in the last experiment, the beholder saw the mixed flames still persist, and not vanish until they were removed nearly an inch away from each other. Then the smoke began to rise again, and the curvatures became dimmer. A similar experiment, with unlike horseshoe magnets—a three-layered and a five-layered—gave the same results with Josephine Zinkel; the mixed flames persisted when I had drawn the two poles about one-twenty-fifth of an inch apart. This was repeated, even with bar magnets, which lay in the meridian. Both were about two feet long, and one inch square in substance. When both lay with their unlike poles joined in the meridian, Josephine Zinkel could not detect the mixed flames in the dark, probably on account of too little strength of the magnets, and too weak intensity of odic light for her power of vision at that time. As soon, however, as I had separated the two bars only to the distance of the thickness of paper, the mixed flames immediately became visible; the northward pole of the one enveloped, the southward pole of the other blue, and *vice versá*, and to a length of about four inches.

407. All this shows with much probability that the odic flame is a true ejection of some kind of substance, which becomes odically accumulated immediately upon the outer surface of the magnet thus brought into a luminous condition, and then thrown out. When it meets with obstacles, it becomes diverted or repelled. An opposite stream meeting it may be an obstacle of this kind; but when the poles of the two magnets are joined, the obstacle is removed, and the mixed flames result. The mixed flame is the action of the residuum of the magnetism and Od arrested in their course at the poles, which, on account of insufficient contact of the steel substance, cannot become conducted away quickly and perfectly enough. The path once opened, the current may persist for some time, from one to another, even in the opposite direction, in its channel. The nearer the opposite poles remain to each other, the more easily will the current be maintained, and be carried on from one to the other; we have already perceived on many occasions that they have no continuity. And the better the ends of the poles fit, the more numerous and intimate are the points of contact of the two poles, so much the more perfectly does the magnetism appear to be conducted, and to be confined within its own circuit; so much the weaker then are the phe-

nomena of odic light; the introverted and intermingled flames then approach to invisibility. We shall hereafter have to examine similar phenomena in the odic light of crystals, and shall there arrive at further deductions.

408. When flames of magnetic bars, no matter whether positive or negative, pass over each crosswise, quite close, nay, so as actually to touch, without, however, running directly against each other, *neither attraction nor repulsion* is exhibited by them. We have seen the like in the preceding experiments with the flames over horse-shoe magnets; they flowed side by side from negative and positive poles, in parallel direction, without attracting, still less lifting up each other. But when the two flames did actually come into opposition, both Miss Reichel and Miss Atzmannsdorfer observed that the *stronger flame always carried away the weaker with it*, yet only when the stream possessed superior force. However, according to a variety of indications from the statements of both observers, that odic flame always possesses the strongest propulsion which lies nearest to its source, that is, the emitting pole of the magnetic bar, and this always carries away with it the other, which, at the point of crossing, is further removed from its source. In these circumstances, it makes no difference which of the flames is the larger: under the given conditions, the flame of a small magnet carries away that of a larger, and rules its course.

409. *The motion* which is communicated to the *odic flame by blowing upon it* has already been touched upon (Part I. § 20.) Since that time I have endeavored to establish it more certainly by repeated experiments with a great number of persons. Miss Sturmann, in the very earliest experiments, remarked that draughts moved the flame backwards and forwards. Miss Reichel amused herself during her sick nights, with making the flames flicker, by waving her hand and giving them all kinds of forms, by blowing upon them. Miss Winter made the flames flare backward and forward by blowing on them; and so also did Dr. Nied. M. Hochstetter blew them apart, strengthened, drove them about, and split them up. Miss Sophie Pauer scattered them among each other by blowing on them, and saw them more luminous as long as she continued to blow. In the presence of Friedrich Weidlich, I blew upon a horse-shoe magnet in the dark, at a part where I had reason to expect the existence of odic flames; he told me directly that they had become interrupted and scattered, but recovered themselves immediately. The healthy joiner Klaiber often moved the magnetic flame in my presence by blowing on it. Professor Endlicher saw the lights, which flowed to a length of four inches from the poles of a five-layer horse-shoe, become brighter by

being blown upon; when he blew along the horse-shoe,—that is, in the direction of the current of flame,—they both became brighter and longer; at the same time, however, flickering unsteadily. M. Delhez breathed upon the flames of the nine-layered horse-shoe, and saw them become brighter and flare about. Madame Josephine Fenzl blew into the flame of an electro-magnet, and saw the flame curl round. Stephen Kollar produced splitting up and flickering of the electro-magnetic current of flame by blowing into it. Wilhelmine Glaser breathed upon a bar lying conformably parallel with its direction; she saw the flame enlarge, and grow brighter. Another time she did this with a nine-layered magnet, and scattered, enlarged, and whirled about the flame. Josephine Zinkel blew down upon the flame of the nine-layer horse-shoe, and made it pass off to all sides, directly she ceased, the flames gathered up and arranged themselves again. When she blew gently along a bar, conformably, she saw the flame become brighter and larger, and spread out like a jet of a gas-light, to which she closely compared it. The Baroness von Augustin blew down along the limb of a five-layer horse-shoe. She then not only saw the odic flame become considerably brighter, and flare, but remarked, that, when she did it in sudden puffs, a little piece of odic flame was detached every time from the pole, and flew on a little distance, independently, before it became extinguished; just as, in a common fire, little portions of flame separate, and sweep upwards in the air alone for a moment. Miss Atzmannsdorfer likewise observed, when she blew in puffs, that little pieces of flame were sometimes detached from their connection with the steel, and swept on a moment free in the air. Thus the observation is confirmed in all quarters, that the *odic flame may be affected, and set in mechanical motion, by the breath, and the movement of the air.*

410. This is the proper place to explain more clearly an observation which was related in Part I, § 13. It is there stated, on the information of Miss Reichel, that the flame of the common magnet was diverted by that of an electro-magnet. This was actually the case; yet not in a stationary condition of the apparatus, but during the rotation of the electro-magnet, which I neglected to note expressly in that place. By the rapid rotation is produced an active draught of air; and it was this which blew aside, and drove outwards, the horse-shoe, as in the cases just described. The fact remains the same; the interpretation of it, however, requires more accurate definition here.*

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* On this, as on every occasion, the accuracy of Miss Reichel's statement is seen, even proving to be right when I at first imagined them to be incorrect. And this is that same Leopoldine Reichel, whom her countrymen, the Vienna physicians, have not been ashamed to describe publicly as a liar and deceiver.

411. If we now collect the observations from § 399 to this point, we obtain, in a variety of ways, confirmation of the frequently-ex-

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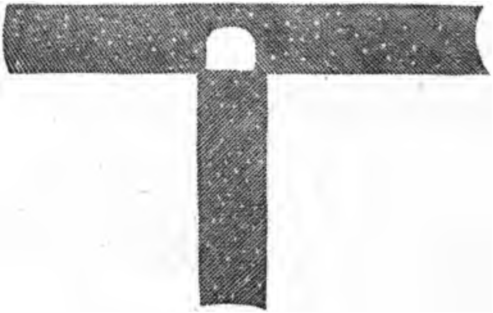
This Leopoldine is a plain but sensible and correct girl, belonging to a religious order, who, during the three months she resided in my house, behaved in the most blameless manner, and so indeed as to acquire the good will of every one. There is no easier way of covering one's ignorance, than briefly to dispose of every abstruse phenomenon, which, from want of knowledge, cannot be understood, and from want of skill in research cannot be made out, with the presumptuous explanation that it is a deception; but there is also nothing more unmanly and dishonorable—I must say it straight out—than to misuse one's power in lightly and ignorantly robbing a poor, sick, and defenceless girl of her only possession, her good name, and to brand her with the mark of shame. When this accusation is an untruth, a flat calumny, as I will prove to these gentlemen by evidence from their own account of their lamentable set of investigations, it is most atrocious, and every honest heart, feeling for truth and duty, will join in my indignation against such unworthiness. I will give them one of these proofs at once here. It is said to be a lie, that Miss Reichel saw magnetic light anywhere. This at once stamped my accounts on this head with untruth, since they rested at first in great part on the observations of this sensitive person. I now invite these scientific gentlemen, of the self-styled committee of Vienna physicians, to visit M. Pauer and his daughter, two persons whose good faith no one in Vienna will venture to question, and to ask them what they saw in the dark, when I placed a dozen different magnets before them? If this does not suffice, I further invite them to ask Baron August von Oberländer, M. Nikolas Rabe, M. Gustav. Anschütz, M. Sebastian Zinkel, whether they saw flames over magnets, or not? I desire them to visit Baroness ven Tessedik, Madame Cæcilie Bauer, Madame Johanna Anschütz, Baroness von Natorp, Madame Kienesberger, Miss Winter, the Baroness von Augustin, and to hear what they saw blazing upon magnets in the dark? Then they may be so good as to inquire of Prof. Endlicher, Messrs. Kotschy, Tirka, von Rainer, Fernolendt, Kollar, Schuh, and Hochstetter, whether or not they saw luminous phenomena upon magnets? I beg them to compare with this what they can obtain on the same subject from the mouths of Madame Jos. Fenzl, Misses von Weigelsberg, Dorfer, Glaser, Weigand, Zinkel, Kynast, the joiner Klaiber, Bollman, &c., &c., well known persons living in Vienna, daily to be met and spoken with. And if all this prove insufficient, I finally direct them to one of their own colleagues in Vienna, Dr. Nied, the physician, of whom they may inquire about the phenomena which were presented to him in my darkened chamber; also of the Stockholm court-physician, Dr. Huss. May they obtain the truth they require! If these honorable persons do not all unanimously say that they have seen extraordinary luminous phenomena, partly luminous vapor, partly colored flames of considerable size over magnets in the dark, then will I own that Miss Reichel never saw light, that she is a liar and deceiver, and that I have really been fooled by her, and thus the true though veiled purpose of these physicians will be attained. But if the reverse happens, and the testimony of all these persons incontestibly establishes the fact of the magnetic light, then I beg these gentlemen not to be angry with me if I say before all the world that they are either miserable experimenters, incapable of performing the simplest physical research with even the appearance of accuracy, or that they must suffer the contempt, which is the reward of unprincipled conduct, to fall away from Leopoldine Reichel, and descend upon themselves. Nature is eternal. After thousand millions of years will the odic light flow and shine as it does to-day. But the endeavors to pressed hypothesis that the odic flame in itself is not magnetism. It does not follow its laws of attraction and repulsion, and is of so material a nature that it may be driven backward and forward like a common flame by movements of the air. It rather manifests the character of an *associated phenomenon of magnetism*, which scarcely follows its current even partially ; it resembles a projectile of it, which, when thrown off, continues its own course in the direction of the impulse which it originally receives, and of obstacles and new impulses it meets in its way.

412. It appeared to me interesting to *apply* the observations gathered on the subject of the odic incandescence and odic flame, *to the common rubbing of steel magnets.* All the lights here described must in this necessarily come to view, and be confirmed in various ways ; and there seemed hope of deriving new information respecting the processes of producing steel magnets, and of the transfer in general of magnetism and Od from one body to another. For this purpose the following operations were performed with Josephine Zinkel.

413. I commenced with *bar-magnets*, and then proceeded to *horseshoes.*

The first manifestation of light which was afforded to the beholder was, that always when I placed the rubbing magnet perpendicularly upon the rubbed, the latter became far more highly incandescent at the part touched. The polar extremity of the rubber thus acted with its whole magnetic and odic force, so strongly upon the rubbed steel bar, that it made it much more luminous where it was in contact with it. Fig. 16 may render this more clear. This luminous

Fig. 16.



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overcome such a truth, when it has once happily been found and disclosed, are paltry and poor.—*Author's Note.*

Some of the most eminent of the London practitioners of physic and surgery phenomenon occurred in every case, whether the contact was made upon the poles, the axis, or any other part of the rubbed magnet. And since it was also extinguished directly the rubber was taken away or carried along, it was consequently found that as the rubber was drawn along from one pole to the other of the rubbed magnet, in the usual pass, the bright patch also moved from pole to pole of the rubbed bar, always accompanying the pole of the rubber as it passed over the rubbed one. And since the rubbed bar, especially when it lay in the meridian, as we have seen above, (§ 338,) has blue odic incandescence on its northward half, and red on its southward, the wandering patch of incandescence also appears with bluish light on the former and reddish on the latter half. With regard, therefore, to the action which a rubbing magnet exerts on a rubbed one in respect to *odic incandescence*, this presents itself to the eye as a *local action*, which is connected with the immediate presence of the rubbing pole, and is not diffused over the whole extent of the rubbed bar, at least not visibly. Here there appears to be a difference between odic and pure magnetic action, as the latter is diffused over the whole of the rubbed bar in every pass, and so not only appears over its totality, but remains attached to it.

In these experiments I used two bars, of which the rubbed one was eighteen inches; the rubber, rather larger and stouter, twenty-four inches long. Let us now examine the process of rubbing, first upon the rubbed bar, then on the rubber; and in the first place with regard to the odic incandescence, and afterwards to the odic flame.

414. A.—*Odic incandescence of the rubbed bar.* I laid a steel bar, which was only weakly magnetic, upon a table, in the meridian. It possessed weak odic incandescence in the dark, so that its northward half seemed to have merely grey instead of blue light, its southward half only whitish yellow instead of yellowish red, both opaque and dull.

I laid the rubber, westward of the former, in the parallel, upon the same table, and moved the northward poles of both towards each other, in such a manner that the two magnets enclosed a right angle between them. Then I began to do exactly as one does when wishing to rub one bar with the other, only with the distinction that I brought both bars into the horizontal position, while it is usual to bring them together in a vertical plane, which might not be exactly the same thing in the essentials of the matter.

The behavior was as follows:

have great need for lessons like the above to be read to them. Charlatanism in professions, like cowardice in rank and file, shelters its dishonor in the fellow-feeling of numbers.

a. First, on contact of the two negative poles, the northward pole of the rubbed bar appeared blue odically incandescent over half its length toward the south; the southern, somewhat shorter half, red incandescent.

b. When the rubber had been moved a quarter of the length along the rubbed bar, the same condition appeared, but now almost three-fifths of its northern part were blue, and only two-fifths remained red at the south.

c. When the rubber reached the middle, the blue incandescence had grown to three-fourths of the rubbed bar; in another experiment, however, in which the latter already possessed some magnetic strength from former passes, the blue northern incandescence terminated at the middle and the red, the southward began thence.

d. The rubber, advanced three-fourths, now reached the red odic incandescence of the rubbed.

e. The rubber arrived at the southern end, the blue appeared to have become shorter, and carried back one half of the length of the rubbed bar, and the red increased at the other end. The red had now grown much more luminous and intense.

415. B.—*Odic flame of the rubbed bar;* and first, the

1. *Blue northward flame*, which was originally weak, and only two inches long.

a. When the northward poles of the rubber and rubbed were brought into contact, this blue flame vanished entirely.

b. When the rubber had advanced only two-fifths of an inch along the rubbed bar, the blue flame again made its appearance on the latter, at first only two-fifths of an inch long.

c. The rubber advanced one-quarter; the blue had increased to about an inch and a half long.

d. The rubber in the middle: it had elongated to nearly two inches and a half.

e. The rubber advanced three-fifths: it had risen to three inches.

f. The rubber arrived at the southward extremity of the rubbed bar: the blue flame of the northward end attained its maximum, namely, five inches.

2. Now the *red southward flame*, which originally was only about an inch and a quarter long.

a. When the northward poles of the rubber and rubbed were brought together, the size reached three inches, which was its maximum.

b. The rubber arrived at one-fourth the length of the rubbed bar: the red flame appeared only two inches long.

c. The rubber, advancing from north to south, and arrived at the middle of the rubbed bar; the red flame had diminished to a little more than one inch.

d. The rubber advanced to three-fourths: the red flame diminished to four-fifths of an inch.

e. The rubber at the southward pole of the rubbed bar: all red color had disappeared.

The course of development in the red southward flame was thus exactly opposed to that of the blue northward flame.

We now pass to the rubber.

416. c.—*Odic incandescence of the rubber.* As it lay originally, and before the contact with the rubbed bar, in the magnetic parallel, it was bluish incandescent in its negative northward half, and reddish in its positive southward half; the two halves were about equal in size.

a. When the northward poles of the two bars (as above stated, forming a right angle in the horizontal plane, since the rubbed bar lay in the meridian) were brought in contact, there appeared at the point of contact of the rubber, which was originally blue, a small patch of red about four-fifths of an inch long; further up it was blue incandescent for about six inches; then followed a length of two inches of grey,—that is, a weak indifferent point,—and beyond this a red incandescent tract, which occupied all the rest of the bar; therefore about seventeen inches. It is striking, and worthy of note, that in this, the stronger of the two magnets, the odic polarity was nevertheless reversed at its northward pole a certain, although but a short, distance from the rubbed bar, and blue changed into red, so that a series of patches or zones appeared upon the rubber; its northward polarity was thus enclosed between two southward polarities. There was consequently the commencement of a triple condition in the rubber.

b. As soon as the rubber had advanced but about two-thirds of its own diameter, that is, about two thirds of an inch, along the rubbed bar, so that it was no longer applied against it as in Fig. 17, but as

FIG. 17.

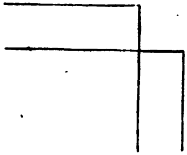
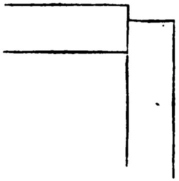


FIG. 18.



in Fig. 18, the red terminal spot had disappeared from the rubber, but at the same time a blue coating, of the diameter of the rubbed bar, was formed, which then, with the further advance of the rubber, grew up into the little blue flame of B *a*, and then into a larger flame. As soon as this terminal red spot disappeared, the rubber was only divided into two fields of odic incandescence; the blue one of its northward half, and the red of its southward.

c. Advanced to a quarter of the rubbed bar: the blue part of the rubber amounted to two-fifths, the red to three-fifths of its length.

d. Brought to the middle: the blue amounted to somewhat more.

e. Carried three-fourths of the distance over the rubbed bar: the blue share made three-fourths, the red only one-fourth of its length.

417. D.—*Odic flame of the rubber.*

Its blue northward flame, originally four inches long, was extinguished by the contact with the rubbed bar, over which this pole passed: we have therefore only to examine its southward flame, the red one. In all these experiments it lay as has been stated in the parallels, its southward pole turned toward the west.

a. The two northward poles being brought together, the southward flame of the rubber appeared three inches long.

b. The rubber advanced to one-fourth of the rubbed bar: the red flame was shortened and brought to two inches.

c. When the rubber arrived at the middle, it bore a flame only an inch and a quarter long.

d. When the rubber had passed over three-fourths, its flame rapidly increased in strength again, and rose to three inches.

e. When the rubber had reached the southward pole of the rubbed bar, its terminal red flame attained its maximum; namely, a length of nearly four inches.

When I now made a movement with the rubber out of the parallel, into the meridian of the rubbed bar, and brought it into straight line with it—the north pole of the rubber in contact with the south pole of the rubbed bar, so that the latter was made to have twice the length—both the northward flame of the latter, and the southward of the former, increased to double their original length; in accordance with experiments and laws already unfolded (§ 401). These laws will be seen to declare themselves in all places throughout the whole series of these paragraphs.

418. A further application of these occurs in the *preparation of horse-shoe magnets by rubbing;* to which we now come. I used as *rubber* a strong five-layered horse-shoe, and, as the rubbed, a one-layered horse-shoe, which had in great part lost its magnetism. The manner in which I proceeded consisted simply in this: I laid the five-layered rubber upon the table in such a manner

that both its poles projected over the edge, and its curvature was turned toward the middle of the table. The horse-shoe was heavy enough to remain motionless in this position during the passes, and so strong that it held the single-layer-rubbed magnet fast in any position; this was applied to its poles. I held the single horse-shoe vertical, with the curvature constantly directed downwards, and the poles upwards. The single magnet had originally and independently in the dark (that is, to the sight at that time of Josephine Zinkel), a little blue flame of about two-fifths of an inch high on its northward pole, but only a reddish smoke on the southward. The five-layered horse-shoe had a northward flame a hand's length, and a southward a finger's length. Both steel magnets were luminous, on the one side with bluish, on the other with yellowish-red odic incandescence; the smaller duller, the larger incomparably more vivid. This incandescence was almost imperceptible at the curvature, and increased continually to its greatest intensity at the poles.

I began with applying the curvature of the single magnet to the two poles of the five-layered, friendly, unlike poles upon each other; it was immediately held fast in the upright position. The result was, that

419. A.—The *odic incandescence of the rubbed magnet* (the single horse-shoe) appeared in greater brightness at the curvature (a), distinctly separated into two halves, into a red and a blue, the first lying on the negative, the second on the positive pole of the rubber; that, moreover, both the limbs of the rubbed magnet at the same time *came into stronger incandescence*, and of the same colors in the said sides, but with increased strength of luminosity. When I now drew the single magnet down upon the rubber, till poles were applied to poles, the incandescence of the curvature increased in both colors, which met in the middle, and passed into each other: on the other hand, the incandescent light was weakened on both limbs, became duller and greyer; but all this did not alter the colors of the odic incandescence; the northward limb of the rubbed magnet always remained blue, the southward limb red. The odic quality thus remained equally negative in all these cases—namely, first, when the single magnet was free; secondly, when its curvature was applied to the five-layered, north to south; and thirdly, when pole was applied to pole in like manner. But the quantitative distribution of Od and magnetism did not remain the same.

420. B.—*The odic flame of the rubbed* (single horse-shoe). When the curvature of this was applied to the five-layered, and it thus closed it like an armature, the little blue flame of its northward pole, which had been only two-fifths of an inch high, rapidly grew to five inches long, and the reddish smoke of its southward pole simultane-

ously changed into a red flame, one to one and three-quarters of an inch long, with dense yellowish-grey smoke above it. In the succeeding experiments, in which the single horse-shoe had become magnetically charged by the rubbing, and its independent odic flame was two and a half inches long, this rose on the application of the curvature to the rubber to nearly five inches on the blue side, and then to two and a half on the red.

When I now drew the rubbed single magnet slowly down the rubbing five-layered, its polar flames were gradually diminished; that on the southward pole soon vanished, that on the northward decreased, and became duller, while the curvature began to get brighter. When the poles of both magnets were applied together, all the flames were extinguished.

In these processes, in whichever of their different phases they might be examined, whatever part of the rubbed magnet was applied to the poles of the rubber, every part of each limb retained its color. The halves of the curvature, the limbs above and below the part rubbed, the odic flames over the poles, the sparks, streaks, and fiery mist around the limbs, all without exception remained blue on the one, red on the other limb, during the whole procedure. In no case did polar quality, but only the intensity of the light—that is, the odic quantity—suffer modification from the rubber.

421. c.—*Odic incandescence of the rubber*, the five-fold horse-shoe. As soon as the curvature of the single horse-shoe was laid before it, and connected its poles, the odic incandescence was heightened in the curvature of the five-fold magnet, and became more brilliant; but the light of the odic incandescence of its two limbs—and still more of its two poles—became weakened in proportion, the northward limb grey-blue, and the southward yellowish-red. Here, also, the curvature possessed both colors, which passed suddenly into each other in the centre. When I drew the rubbed magnet slowly downwards, the two poles of the rubber became gradually more incandescent. They attained their greatest brightness when all the poles were applied together; but still this did not come up to the brightness of the curvature. The odic incandescence of the rubbing magnet thus took an almost converse course from that of the rubbed, at the same time agreeing with the general rules already known.

As soon as I pulled off the rubbed magnet from the poles of the rubber, the curvature and limbs of the latter decreased in incandescence, but its poles increased in luminosity. No odic flame of the rubber can here be subjected to examination; since, as neither of its poles were ever free, but always applied to the rubbed magnet, no odic flame existed.

422. An experiment of rubbing horse-shoes with their like poles together, in the manner adopted with the magnetic bars mentioned at § 403, gave similar results, and served to confirm the former. I laid the northward pole of the single horse-shoe on the northward pole of the five-fold one; the southward poles in like manner together, at right angles, as before, and now rubbed from the poles toward the curvature: the poles having been previously reversed, when the pass was also reversed, the effect should coincide with the preceding one. The behavior of the odic incandescence here was as follows:—As soon as the corners of the like poles came in contact, a little patch of red odic incandescence, only two-fifths of an inch long, appeared on the blue northward pole of the rubbed single magnet; and on the red southward pole of the same a similar little patch of blue odic incandescence, likewise two-fifths of an inch long. As soon as I had pushed the single magnet two-fifths of an inch forward, these spots of light both vanished, and the northward pole became blue, the southward red, exactly in their regular way, and they remained so during the remainder of the passage of the magnet. These two terminal patches of reverse odic incandescence are the same that we became acquainted with on one side at the negative poles of the bar magnet—a reversal of the polarity of one pole by means of the other of like quality. The single magnet was thus many-poled at the first moment; two-fifths blue, then the whole length of a limb red, the other limb blue, and lastly, two-fifths red at the other extremity.

423. *The force* which prevails in these objects *is consequently never uniformly distributed; not even when the magnetic circuit appears closed.* The state of continuity, as we have seen above in the intermixture of the poles in the magnetic flames, § 404 to 407, is probably never perfect; and hence, leaving out of the question the disturbances of equilibrium through the influence of terrestrial magnetism, these constant inequalities in the distribution of the force. New examples of this are afforded by some investigations on the

424. *Influence of the armature on the phenomena of the odic flame of magnets.* We have seen above, that the armature, applied to the horse-shoe, weakens the odic incandescence of this, while at the same time it heightens that of the curvature. But the odic flames, according to all the sensitives who possessed the power of seeing these lights, were immediately extinguished when an armature was applied to a horse-shoe; observations particularly bearing this out are noticed in my journal on experiments, from Madame Kienesberger, Misses Winter, Dorfer, Friedrich Weidlich, the healthy Josephine Zinkel, Ma-

dame Josephine Fenzl, Baron von Oberländer, Professor Endlicher, Baroness von Augustin, and others.

425. When I applied the armature to the horse-shoe, low down, on the curvature, before the first of the above-named observers, in the darkened chamber, this, as was to be expected, had no particular influence upon the flames of the poles. But as I moved the armature slowly up along the horse-shoe toward the poles, keeping it always across the limbs, a continual weakening of the odic flame of both poles resulted, these always diminishing until I brought the armature to the poles, when the flames were wholly extinguished, and the armature covered them. When I proceeded in the opposite direction, that is, passing the armature gradually down from the poles to the curvature, a similarly gradual restoration of the odic flames of the poles resulted. The course was as follows: as the armature passed upward, the beholder saw the polar flames at first become duller, the blue became greyish, while the red passed into a dull yellowish; during this the length of the flames was gradually diminished. When it came to the middle of the limb and went above this, the reddish yellow of the southward pole disappeared, and now only a reddish smoke remained over it; the diminished bluish northward flame was discolored quite into grey. When it arrived near the poles, this was also extinguished and converted into grey smoke, and this finally vanished altogether when the armature was applied upon the poles. In the passage downward, all these phenomena occurred in the reverse order: at first a grey smoke appeared at the negative pole: then followed grey flame; next red smoke at the positive; after that the blue, and then the red flame, at first small, growing larger: finally, when the armature arrived at the curvature, all the original phenomena of the odic light were fully represented. The odic incandescence of the horse-shoe was originally very weak at the curvature, strong at the poles; but with the removal of the armature upwards, the curvature gradually became visible, and as the poles were rendered more dull in their incandescence by the advance of the armature, the incandescence of the curvature was, step by step, increased, till at last, when the armature covered the poles, it almost equalled the limbs and poles in brightness.

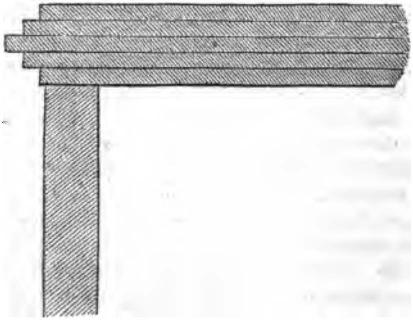
426. But the armature itself also gained and lost odic incandescence during this. When it lay upon the curvature it was grey and scarcely visible; when it lay upon the pole, it had become more strongly incandescent and colored,—on the side turned toward the northward pole of the horse-shoe reddish,—on that toward the southward pole bluish; at all the intermediate stages it possessed corresponding transitional luminosities: it was itself converted into an in-

duced magnet, and bore the colors of odic incandescence regularly corresponding to this. But they were always rather duller than those of the inducing magnet poles. These phenomena explain themselves, if we in each case regard the part of the horse-shoe from the curvature to the armature as a piece cut off from the whole. The larger this is, the smaller remains the residuum of the limb; the shorter, therefore, will be the polar flames remaining to it, and *vice versâ.*

427. I endeavored to test *the conditions and effects of the armature upon the horse-shoe magnet during the pass.* This was done with Josephine Zinkel, in the opportunity afforded by the experiments just now discussed, with a five-layered rubber and a single rubbed horse-shoe, when under the above described conditions, (§ 418, at the end,) while the curvature of the rubbed magnet was attached to the poles of the rubber, and this was thus closed by it as by an armature; the odic flames then blazed most vividly above the poles of the rubbed magnet. I applied the armature to them; it adhered firmly, was converted into an induced magnet, with strong odic incandescence, the colors being opposed to those of the poles of the horse-shoe. The limbs themselves were considerably weakened in their incandescence, the negative blue became bluish grey, the positive red dullish yellow-red.

428. When I drew the rubbed horse-shoe down the rubber till their poles met and the armature was again applied to the rubbed magnet, as is shown in fig. 19, it in like manner became firmly attached and was again converted into an induced magnet with stronger odic incandescence, but the *colors of the incandescence were now reversed,* no longer opposed to the colors of the poles of the rubbed

Fig. 19.



horse-shoe, but of the same color as them, and therefore *opposed to those of the rubber*. From this it follows that the armature was no longer within the influence of the rubbed magnet on which it lay, but had come under dominion of the rubber: and this not, indeed, immediately, but by means of the little tract of steel constituting the polar extremities of the rubbed horse-shoe. These must have been first converted into short induced magnets, and then, from these, was the armature changed into an induction magnet of the rubber. Here all these processes presented themselves quite clearly to the eyes of the sensitive, which the science that would hitherto make no use of the capacities of the sensitive, could only discover by tedious and uncertain methods.

429. The question now presented itself, *when and where does this remarkable reversal of the poles in the armature of the rubbed single horse-shoe take place?* To find this out, I closed the five-layer with the curvature of the single horse-shoe, closed the upward directed poles of the latter with the armature, and drew it slowly down the rubber, allowing the sensitives to observe and describe the armature to me from time to time. When the single horse-shoe had passed down two-thirds of its length, so that only one-third stood above the rubber, the armature, which when first applied had been attracted very strongly, fell off of its own accord. I applied it again, but found that it did not adhere in the least, and the single horse-shoe had lost all attraction for it. This continued until I had drawn down the single horse-shoe three-fourths of its length. Then the armature again began to acquire attraction toward the poles of the single horse-shoe, which went on increasing as I drew it farther down, and was strongest when I applied it to the poles of the rubber. During this the behavior of the colors of the odic incandescence was as follows: at first the armature was colored oppositely to the single horse-shoe,—it formed an induction magnet of it. As I drew the single magnet downwards, the intensity of the light and colors of the armature decreased, became duller, the colors more indistinct, confused; and when I had moved it down two-thirds, all the color had disappeared from the armature; it now possessed only a dim uniform grey, like any other piece of iron. Thus it remained till I had passed it more than three-fourths down; from hence it again began to get brighter, then its two halves to acquire distinct colors, but now the reverse of what they had before; its red and blue were now no longer opposed, as before, to the rubbed single horse-shoe to which it was applied, but to the rubbing five-layered magnet, to the poles of which it had now approached. Thus the indifference point of the coloring coincided with the indifference point of the polar attractions;

and these results beautifully support the parallelism of these two phenomena under common circumstances.

430. It is also found that in the condition of the armature, in which it has no attraction for the single magnet, and remains uncolored in grey odic incandescence, the curvature of the same horseshoe has also become light again on one side, but has only an uniformly grey luminosity. *Thus there appears to be a condition of neutralized indifference both above in the armature and below in the curvature*, when the single horse-shoe adheres at two-thirds to three-fourths of the length of its limbs to the five-layered rubber.

431. Once, in the condition of menstruation, when the sight of the observer was three or four times stronger than usual, she saw the single horse-shoe, which, from the repeated passes, was now in the magnetic condition, with a blue flame of six inches long at the northward pole, and a reddish of two inches and a half at the southward. When I now laid its curvature on the poles of the five-layer, friendly, unlike sides together, both the blue and the red flames at once increased about one-half. When I drew the single magnet downwards, its polar flames decreased; and by the time that they had come back to their original lengths of six and two and a half inches, I had moved down one-third of the limb; in this position, therefore, *the effect of the rubber upon the odic flame of the rubbed magnet equals* O: the flames were thus brought into a certain equilibrium, that of the rubber upon the poles of the rubbed horse-shoe being removed, at least *in odic respects*. When I drew the single horse-shoe further down, to two-thirds of the length of its limbs, I arrived at the *point of magnetic indifference*, where the magnetic forces were removed from the poles of the rubbed magnet on to the rubber.

432. But the *divergence between the odic and magnetic activities*, which manifested itself in these processes, was very remarkable. In the experiment just detailed (which was also repeated at various times, also that of the menstruating period), when the magnetism of the rubbed horse-shoe was = O at the poles, and the armature fell off, this was by no means the case with the odic flame. It was, indeed, depressed and diminished on the blue side down to one and a quarter inch; and on the red, reduced to red smoke; thus altogether brought down to about a fourth or fifth of its original and proper size, but not by any means destroyed, as the magnetic attraction was. Nay, more; when I drew the single magnet down three-quarters and more, and the color of the armature lying upon it changed in such a manner that its side lying on the negative limb of the single magnet became blue (according to § 427), yet the residue of the odic flame remained permanently blue. This little flame de-

creased as I brought the poles of the single horse-shoe down to those of the five-layered, from one and a quarter to four-fifths, two-fifths, one-fifth, one-twenty-fifth, to the thickness of a sheet of paper, at last waving as a delicate blue mist over the negative polar extremity; but always blue and blue grey down to the last moment, when pole joined pole, and all flame vanished entirely.

433. Here the *difference between the behavior of Od and magnetism* comes strongly into view. While the negative magnetism of the northward limb of the single magnet was reversed above into + M, the flame attached to it remained blue, and persisted in — Od; from steel which gave out + M, and induced — M in the armature in contact with it, issued the blue manifestation of — Od, unrestrainedly, so long as the armature remained off: *positive magnetism and negative Od may thus co-exist simultaneously in one and the same steel bar.*

434. As *electro-magnetism* is a means of producing odic incandescence in iron (see above, § 374), so it is also of calling forth odic flame, and this in an uncommonly high degree (§ 12). In the experiment just cited, and to which I refer for the sake of brevity, the healthy and imperfect seer of odic light, Baroness Pauline von Natorp, perceived on a large iron horse-shoe converted into an electro-magnet, not, indeed, flame, but an appearance of luminous vapor rising a hand's length high, in the dark. Madame von Tessedik detected the same subsequently in about equal degree. M. Pauer saw a luminous flame, from twelve to sixteen inches, like a mass of luminous vapor, upon each pole. Madame Josephine Fenzl saw flames ascend from both poles of the same electro-magnet, the stronger ten inches high, the negative more grey, the positive more yellowish. Baroness von Augustin saw at both poles a flame-like luminosity, about twenty inches broad, and almost of a man's height, ascending perpendicularly toward the ceiling of the dark chamber; their upper halves were blue, the middles brighter and whitish, and the lower parts duller again. They were unsteady, and passed above into clouds of smoke. Stephen Kollar, with a simple Smee's apparatus, at first saw only the negative pole, but with two pairs, both poles, flaming about twenty inches high, and with smoke ascending a long distance. The far more sensitive Madame Kienesberger saw a colored flame of eighteen to twenty inches blaze perpendicularly upward on the negative pole, and on the positive a smaller red one of six inches, both vanishing into smoke. She described both flames as rather more unsteady than those of the common permanent magnet, and somewhat jumping, like the light of a tallow candle. This jumping, a constant alteration of size, a continual vibration between

greater and less height, was doubtless caused by the varying quantity of electricity developed from the Smee's battery and conducted through the wire coil at different intervals; that is, by an ebb and flow in the inducing agent, depending upon inequality of chemical activity among the elements of the battery. I must observe here—what I shall return to subsequently—that both the conducting polar wire, and the coil upon the iron horse-shoe, were enveloped in flaming appearances of odic light. And these flames were more luminous towards the poles, and duller towards, and at the curvature of, the electro-magnet. In the order of time she first saw odic incandescence; then, after the lapse of more than a minute, sometimes two minutes or more, the flames were found at the poles; at first greyish and weak, and then developing into colors as they increased. The reverse occurred when the voltaic current was interrupted; first the colors of the flames disappeared, then their grey shape became invisible; at length the odic incandescence vanished. Professor Endlicher saw an electro-magnet decked with vertically ascending emissions of light at both poles, forty inches high, moving unsteadily, variously colored, and sending up dimly luminous smoke to the ceiling, which appeared lighted up by it. M. Delhez saw flames almost as large, but he could scarcely distinguish colors; he found the columns of light duller (red) below, brighter (yellow) in the middle, and duller again (blue) above. Wilhelmine Glaser saw the same electro-magnet furnished with flames sixty inches high at its poles. Smoke ascended from these up to the ceiling, and the flames displayed the most brilliant coloring,—blue prevailing at the northward pole, and reddish-yellow at the southward. The odic flames of the electro-magnet were observed more accurately and more frequently by Josephine Zinkel. Under the circumstances above described, she saw flames forty inches long upon the northward pole, and about thirteen inches upon the southward, both colored; the first with predominance of blue; in the second more red. She described the flaming appearances upon the polar wires, the coil, the voltaic battery, and the order of succession of the appearance and disappearance of these phenomena, always exactly like Madame Kienesberger. She once found, however, five or six minutes necessary for the complete development of the odic flames; another time she declared that they did not unfold to their persistent size until after about ten minutes. In the last experiment with her I had used a Smee's apparatus, with five square feet of zinc and silver surface. The columns of light ascending from the two poles, astonished the observer with their beauty and size. The negative flame was higher than a man; the positive, of an arm's length. They constantly trembled and leaped up and down, like a monstrous candle flame, decorated with the most beautiful prismatic colors. Sparks flew off in streams into the smoke, and off to the sides. The smoke came in contact with the ceiling, and was diverted by it.*

I showed to Miss Reichel a Schweigger's multiplier in the dark, sending a weak voltaic current through the coil. She saw the wire, and then the steel needle, become odically incandescent, and next a delicate stream of odic flame break out from the points of both its poles, flowing onwards in the direction of their length on each side; but, as the case was too narrow to allow of their flowing straight out, they ran against the sides, turned upwards on them, then again met the glass cover, were diverted once more, and, finally, flowed over the surface of the glass till they vanished from the eye.

435. The part which the *electrical atmosphere* plays in odic phenomena, we already know, from the odic incandescence (§ 370), to be influential; but in the flaming appearances it asserts especial importance. Miss Reichel found the flames increase whenever I brought a magnet within the electrical sphere of action. Miss Atzmannsdorfer showed me the same on many occasions; the account was already different from these two. M. Hochstetter saw the usually twelve-inches high flame of the nine-layer magnet rise to twenty-four inches. Miss Sophie Pauer saw the same nine layer magnet triple its odic flames in the electrical atmosphere, in some degree illuminating the ceiling. M. Fernolendt saw the sixteen-inch flame of the same rise to thirty-six inches, and throw light upon the ceiling. Wilhelmine Glaser saw the flame of a bar-magnet twenty-five inches long, when the negative pole was brought within forty inches of the conductor of the electrical machine, become four times as long,—namely, increase from three inches to twelve. She observed the common flame of sixteen inches upon the nine-layer magnet; when I brought it into the vicinity of the electrical conductor, she discovered an elevation to sixty-four inches—thus to the height of a man, with illumination of the ceiling. Madame Bauer saw pretty nearly the same phenomena under the same circumstances. Baroness von Augustin, when the nine-layer magnet was brought with its negative side to within about twenty inches of the electrical conductor, saw its blue flame enlarge to twice or three times the size, and light up the ceiling of the room. I laid the nine-layer horse-shoe before the girl Zinkel, in the dark chamber, at a distance of forty inches from the conductor of a powerful

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* Many remarkable corroborations of the facts in this paragraph have been witnessed, at my house, by several persons who have seen my experiments upon at least twenty somnambules with Smee's batteries, electro-magnets, and helices.

electrical machine, which I set in motion. It stood with the poles turned upwards, and the limbs equidistant from the conductor. The odic flame was originally four inches on the negative pole, and about one and a half on the positive; the former now rose to twenty, and the latter to six inches. The size of both was thus increased from four to five times. The coloring was rendered more vivid in the blue, and bedimmed in the red. As soon as I stopped turning the plate of the machine, the odic flames sank down to their previous size. This was frequently repeated at different times.

436. After the Baroness von Augustin had seen the great increase of the blue magnetic flame on the negative pole in the vicinity of the charged conductor, I turned the nine-fold horse-shoe round in such a way that the southward pole was towards the conductor, both poles pointing upwards. In a short time she no longer saw reddish odic flame over it, but blue. In this arrangement the odic colors of the two poles were reversed. When, in other experiments with Josephine Zinkel, I turned the blue, negative pole of the nine-fold magnet to the conductor, so that the positive red flame was turned away, the latter appeared greyish red, the former brilliant blue, and developed prismatic colors, above which smoke and sparks ascended almost to the ceiling. The flame was so brightly luminous that the beholder could not conceive how it was that I saw nothing of it. But when I turned the magnet round, so that the red-flaming positive side was turned towards the positively charged conductor, while the blue, negative side was turned away in the opposite direction; the former, the red, first quickly became dull grey, and then, in half a minute, changed to blue, whilst the opposite blue upon the negative pole became violet grey; the blue of the former then increased, and that which had become reddish grey, shrank away: thus here, as in the odic incandescence (§ 371), there was a *reversal of the odic polarity* of the odic flame, without this being accompanied by any simultaneous reversal of the magnetic polarity. The electrical polarity here dictated the law; it reversed the odic, but was not capable of reversing the magnetic polarity. When I now reversed the electricity, and charged the conductor negatively, I obtained the same, only correspondingly reversed, manifestations of odic light: now the red flame turned toward the conductor became exalted, and when I turned the negative side of the magnet to it, the blue was changed into red, the — Od was converted into + Od, and this at the negative pole of the magnet.

437. To work out these facts more clearly, I repeated them with the application of bar-magnets instead of horse-shoes. Two bars, one twenty-six inches, and the other six inches long, were placed, uniso-

lated, on the parallels, lying upon a table at a distance of forty inches from the conductor. When I turned the blue-flamed poles to it, the blue flames flowing from these grew to three or four times their length, stretching out towards the positive electrical conductor; when I turned the red-flamed poles to it, the flame first became bedimmed and weakened, and then, after a contest of the dynamics here in action, rendered visible by lambent flames playing up and down upon the bars, it was converted into blue, and within two minutes raised to considerable size and thickness. As often as I discharged the conductor the flame sprang back, and returned to its original condition of polarity and magnitude; the struggling, lambent flames, resembling dying flames of spirit of wine, played up and down upon the steel rods, till all was carried back into the true condition in which magnetism ruled.

438. The phenomenon displayed itself still more beautifully when I brought the magnetic bars nearer to the conductor. I did this both with a rod of square and one of equal size of circular section, both held in a wooden Guidoni's holder. While they remained at some distance, the polar flames were always blue on one side and red on the other. But as I approached the bars gradually towards the conductor, and the vividness, luminosity, and brilliancy of the flame increased with this, other colors were by degrees developed out of these two, till at length, when I had brought them within about a foot of the conductor, all the prismatic colors displayed themselves in full splendor to the eyes of the sensitive observers. I shall recur to this, for more complete details, when I speak of the odic colors.

438. *b.* We thus see here the odic flames subject to the same effect from the electrical atmosphere as occurs in a similar manner to the odic incandescence; and, as in most of the phenomena, hitherto, *we have seen magnetism holding to a certain extent the upper hand over Od, we here see electricity, alone, claiming dominion over it, with greater force.* It is evident Od is more intimately connected with electricity than with magnetism,—that the dependence upon the poles of magnetism is soluble, variable, and not one of necessity,—that it shows the mobility of electricity rather than the fixity of magnetism, that it only so far partakes of the fixity of the latter at the poles of magnets, as this fixity dwells in the magnetism,—to which the Od is to a certain extent connected. Therefore *Od* here shows itself more clearly than anywhere else, *in a kind of mean between electricity and magnetism.*

439. The *influence of terrestrial magnetism* upon the size and brilliancy of the odic flame of the magnet is manifested pretty strongly, and proceeds parallel with its influence upon the odic incandescence.

When a bar magnet lies conformably in the magnetic meridian, its flames are longest and most luminous. When turned round and placed unconformably, with its northward pole toward the south, the blue northward flame was depressed, dull, inclined toward grey, dim, misty, less apparent, more difficult to see, and diminished in size; the reddish southward polar flame weakened in like manner; rather yellowish grey than red. Josephine Zinkel saw the flames somewhat modified in every point of the compass. The same was the case when I placed a horse-shoe magnet before her with its poles upward; if the northward limb was then turned to the north, the blue and red flames were then vivid and brilliant; but if the southward polar limb was on the north side, and consequently the northward polar limb on the south side, the beholder perceived only dull, troubled, and weakly-colored odic flames, sometimes both only grey, or even passing into mere grey smoke.

440. The same circumstances presented themselves when I brought the magnets—in the vertical plane of the meridian—into different angles with the dip. The condition of the odic flame altered in size and coloring with each position: this was the case even when horse-shoes were closed by their armatures.

441. Even *mere pieces of iron* turned upon their axes in the plane of the meridian, exhibited odic flames, and modifications of them according to the difference of the directions. I shall enter more minutely into this subject in its proper place. Madame Kienesberger woke up one very dark night. Looking round the room, she perceived a flaming appearance at the window. She started up in a fright to extinguish it, under the apprehension that something had taken fire. But when she came close to the window, she could see nothing; the appearance of fire had vanished. Returning to her bed, she saw the fiery brightness again at the same spot; she went towards it again, and again lost sight of it. It was an iron window-bar, which, standing perpendicular, emitted odic flame at the top.

442. But not only do magnetic and electrical influences affect the odic flame, even purely odic react independently upon it. To these belong, in the first place, *crystals* of all kinds, of earthy or saline compounds, in which we have never hitherto known of properties of the kind which occur in magnets in the strict sense. We have seen above that when a magnetic bar is appended to another of equal size and strength, the intermediate flames become dull, and the flames of the extremities increase almost to twice the size. A crystal produces the same effect. When I applied to a bar magnet, a crystal of equal length of rock crystal, selenite, or heavy spar, the negative pole of the crystal to the southward pole of the magnet, holding the

two in a straight line, Josephine Zinkel, Mr. Kienesberger, Miss Atzmannsdorfer, Freidrich Weidlech, and Wilhelmine Glaser, saw the blue flame of the northward pole of the magnetic bar almost double its length. When I did this at the other end of the magnetic bar, with the positive pole of the crystal, the same sensitives saw the end flame of the southward pole of the magnetic bar become elongated. *Thus, the crystal acted just as powerfully upon the odic flames of the magnet as a magnet itself, although it did not increase the supporting power of the magnet a single grain.* The independence of the odic action is thus most evident here.

443. If this experiment were accurate, it should be confirmed by a controlling experiment; namely, the behavior of the magnet flames when crystal flames were held against, and approximated to them, in the way the flames of the magnetic poles were brought together, described above, § 401. To test this, I placed before Josephine Zinkel a magnetic bar six inches long, brought it into conformity with the meridian, and approached its southward pole to the negative pole of a selenite, the blue flame of which measured about two inches. As soon as the two poles (the polar objects being in a straight line) came within about a foot of each other, both flames became more slender and elongated, flowed towards and appeared to seek one another. When, by a closer approximation, they should have met, this did not take place; they did not join, but gradually became thicker and shorter again, accumulated around their own poles, and went out as soon as these came in contact. But when I brought together hostile,—that is, like poles, the beholder saw no elongation of the approximated polar flames, but a speedy contraction; and, finally, on the complete contact of the two solid bodies, an introversion of the odic flames around their own poles,—all agreeing with the luminous phenomena of two approximated steel magnets, one of the magnets being here completely replaced by a crystal of selenite.

444. *Animal organs,* especially the human hands*, constitute, per-

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* There is no subject, in the range of philosophy, which admits more extensive application of thought than that of light. Its relations are quite universal. The most sublime idea of the theologian when he endeavors to embrace an impossibility, the boundary of time, space, and eternity, is that magnificent sentence, "God said, let there be light, and there was light." A sentence pregnant with the germs of all the laws regulating the universe,—of all the clearness of radiant matter, and of all the darkness which envelops the confusions of mental and physical philosophy.

The finest devotion of the humble moralist to the best idol of poetic-fancy, is the attempted imagining of truth in the shape of ethereal light, an impersonation of the Deity. It is absolute humility in the worship of perfect goodness and perfect intelligence; the seal upon the fiat, that without the whole truth to enhaps, a still more striking means of strengthening the odic flames. I fastened a magnetic bar of about eight inches length into a wooden

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lighten our judgments, all our conclusions must swerve more or less from the standard of pure justice.

Pride cannot guide the search for truth, although it lead the chamois to desire the mountain top, and the votary of severe physical science to the highest altitude of ambitious man's enjoyment,—the pinnacle of human fame! The natural philosopher, whose researches dive into all depths, is not permitted, by the laws of justice, to arrogate to himself the habits of the bigot, or the claims of scientific authority. Happy he, if where his studies lead to thoughts which establish numerous important facts, he be permitted to approach in his speculations the lamps illuminating the temples of truth. An unsettled wanderer, his is never the privilege, for petty selfish advantage, to fix his abode. Like the humble miner he gropes, and helps, with his dark lantern, to find the ore which enriches him who has not tasted of the labor expended in its production. If it be thought that Newton, who poured floods of mental light into optics, was an exception to this rule, that thought is erroneous, for never was humility more tenderly striking than in his character, and, when the extent and importance of his discoveries are regarded, never, in his own time, did man reap less personal reward. So striking is the inference, in fact, that in the yearnings and efforts made for the summit of felicity, by even the most exalted human character of several ages, that middle course which lies between two extremes or poles, the happy medium of moderate desires, the pursuit of truth in humility, the indulgence in the love of science for its own pleasures, in the calm light of a contented mind, is more to be coveted than any brilliant blaze of dazzling fame. It is evident that in the researches of the Baron von Reichenbach, the bold love of truth has stimulated an industry guided by the severe training of a correct logic; and if in these notes any passages are found reflecting on the Baron's thoughts, their aim is more to guide the attention to facts,—which are sneered at only by those whose brains are unfortunately formed, or by those in whom the happier influences of justice have failed to correct the pressure of silly prejudices,—than to evince the very slightest disrespect to extensive acquirement guided by moral excellence.

To show here that "*animal organs*" have been observed under various circumstances to emit light, and that there exist probabilities of the analogies afforded by phenomena, long ago observed by inquiring philosophers, to those which have been the subject of our author's investigations, will not be irrelevant, how much soever some of the speculations naturally arising may be distasteful to that school of philosophy, which retains the right of rejecting all knowledge, not based on those foundations, laid by certain instruments and tools, in common use, by its own artificers. The Baron von Reichenbach has done well in admitting oral testimony into science, for now the germs of much future progress in knowledge may be watched by greater numbers in their development. The combined music of truth from such sources may, in choral harmony as it were, be attuned and reverberated by many statistical aids. If the relation of single or isolated facts be rejected,—though wise students would never rudely or heedlessly pass them by,—the repetitions of a thousand different observers, each having had multiplied opportunities of verification, would constitute a statistical value, which the severest devotee to prejudice could not wholly underrate. In drawing attention to facts long ago noticed, perhaps then isolated, but since observed by very numerous persons, the importance of the state of somnambulism in such researches as those recorded in our author's text must be again vindicated. In

Guidoni's holder, brought it into the conformable direction with the meridian, and led Miss Atzmannsdorfer to it in the dark. When I

the interesting "Journal du Traitement Magnétique de la Demoiselle N." (pp. 56–57), M. Tardy de Montravel relates that on the 13th of April, 1785, the lady who was the subject of his observations perceived, upon the surface of the baquet, a very light vapor, which appeared to be in motion, and which, rising along the iron rods then used in the practice of animal magnetism, seemed to be *attracted* by the patients. At first she was interested by this phenomenon, but soon her head became heavy, and she had a sensation of movement about the frontal sinuses. She had no desire to sleep, but had a palpitation which was perceived by the bystanders. Here was a case in which, according to my view, the vapor contained Reichenbach's odic force negative, or the mesmeric imponderable agent repulsive, increased in its unpleasant effects by an iron conductor. In other cases the same description of vapor has been observed of a grey color. M. Tardy, in trying to get his patient to observe the mesmeric fluid emanating from himself, learned from her, when she was asleep, that his thumbs shed brilliant sparks of light (p. 63), that the palms of his hands shed a vapor, not brilliant, (p. 64.) In repeating his observations and varying his experiments, he arrived at the Baron von Reichenbach's conclusion, that the light emanating from the thumb of the right hand was rather larger in volume than that from the left (p. 70.), With his face to the north M. Tardy mesmerized some milk, and his patient saw the sparks of light proceeding from his thumbs, and the surface of the milk glittering with sparks (p. 72). Various other experiments were made, the results of which were, that the light was seen conveyed along rods of steel, through planks of wood, at the spots corresponding with those touched on the side proximate to himself. On other occasions she indicated the season of the year when the fluid had the greatest amount of force. Less in winter than in summer. Then, as to particular times of the day, more from eleven o'clock in the morning until three in the afternoon (p. 12.) The sources of the fluid? The earth and the air. That from the air is the purer, &c., &c. The sun is the most abundant source of this fluid (p. 126.), Its direction is influenced by currents of air (p. 127.) It can traverse glass (p. 137.) Disregarding the hypothesis of an universal fluid, so fashionable for a time among the cultivators of mesmeric science, the remark may be allowed, that the Od of Reichenbach is embraced in an idea, somewhat analogous in some of its properties and relations to that supposition, based, however, upon a very different course of investigation. We are constrained, nevertheless, to allow that although the Baron is more close in his train of philosophy, the *facts* brought out are, in many cases, analogous—almost identical. It has been on purpose that Tardy has been selected, on account of the date of works, but from his period to the present day the facts on the emission of light from the fingers, pit of the stomach, eyes, nostrils, mouth, and in a less remarkable degree, from the whole surface of the human skin, as seen by many somnambulists, are too numerous, and too well vouched for, to admit of any reasonable doubt. I have, myself, been very frequently present, on occasions when numerous persons, on other occasions when individuals knowing nothing of each other, and in presence of myself alone, having been placed in a condition of sleep-waking, have stated facts *corroborating every statement* made by Tardy de Montravel. I have seen many individuals male and female, who could, in ordinary wakefulness, in full vigilance, perceive blue, green, or yellow emanations of light from the ends of the fingers of other persons, from the eyes, and during the expiration of breathing from the mouth and nostrils. Persons of a very highly sensitive nervous organ-let her grasp the southward pole of the little bar with the fingers of her right hand, she saw the odic flame of the northward pole of the

ization are not uncommon, who, in the shade of a sombre room room, have the power of perceiving these appearances. A lady lately residing at the Mesmeric Infirmary is a remarkable example of the possession of this faculty. Long ago such things ought to have excited greater attention, for the facts connected with animal light are well known, and have attracted the notice of philosophers of no common calibre of intellect. My late revered friend and preceptor, Dr. James Macartney, professor of anatomy in the University of Dublin, published in the year 1810, in the Transactions of the Royal Society, a remarkable memoir on this subject, so full of the just feeling for investigation which distinguished him as an active and ingenious philosopher, that any one who knew of the vast amount of knowledge he had accumulated could not but deeply regret his not having left behind him, in some printed form, the marrow of a most extensive course of lectures which annually stimulated the intellects of a large concourse of admiring and affectionate pupils. His copious fund of original facts, and his novel and correct trains of reasoning, impressed convictions on the minds of many a student who has gone forth to contribute his master's ideas as well as sometimes his own share of information, to the general stock of useful knowledge, but the venerated preceptor has left little that could add to his own fame, besides the remarkably original thoughts in his work on Inflammation; the translation of Cuvier's Comparative Anatomy; and a few papers communicated to learned associations, and I should add, the noble museum of anatomy now in the University of Cambridge. Macartney established by his discoveries on the evolution of light from the bodies of living animals, certain propositions that were highly important, which must, in due course, meet our attention; but subsequent laborers, in the same field have much advanced our knowledge of the natural history of animals emitting light. The researches of Professor E. Forbes, published by the Ray Society, in his Monograph of the British Naked-eyed Medusæ, in a work remarkable for extensive erudition, and evincing the power of the author's mind in the exercise of deep thought. The student investigating this subject will find an interesting bibliography in this work. The best *summary* of the knowledge on animal luminousness is to be found in Todd's Cyclopedia of Anatomy and Physiology, from the masterly pen of Dr. Coldstream.

If we ask ourselves the question, what is light? what do we know of light? shall we, reflecting upon the facts of Reichenbach, or upon the luminousness of animals, leap to the conclusions that we may search for the essential causes of this imponderable phenomenon in the natural history of organized beings? or shall we be content, in treading the beaten path of knowledge, to conclude that a proper definition of light is, that it is "the cause of those sensations which we refer to the eyes, or that which produces the sense of seeing,"—aware that thus we shall discard from our attention all the curious facts connected with mesmeric science, and others relating to animal light. To define a matter, we should give some account of its characteristic properties. Is it a property of light to cause the pain inflicted by the sharp end of a pair of scissors upon the eye, or that of an ulcer left by small-pox or any other morbific poison? Each may be "the cause" or antecedent to "the sensations we may justly refer to the eye." But is it not absurd to admit that light can be *thus defined?* We cannot see without light; but then, in such case, we acknowledge it only as one of the conditions necessary to the exercise of the faculty of vision. Jane M., a clairvoyante, was for several weeks an inmate at my house in Grosvenor Street. I have now narmagnet grow longer, and the intensity of its light increase. When she did the same with her left hand at the negative pole, the flame of the southward pole increased. When she took hold of the same poles with the reverse hands—the southward pole with the left hand, and, *vice versâ*—she saw the odic flame of the other end become weaker and duller. I repeated the same experiments a year later with Josephine Ziukel, with the same results. *Their hands thus acted upon the flame exactly like magnets.* The application of their own negative hands to the positive pole of the magnet considerably in-

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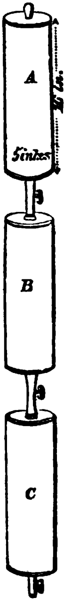
rowly watched her for more than two years. Hundreds of persons have witnessed many curious and delicate mesmeric phenomena in her case. I have occasionally shut her up in a dark chamber, in which she has occupied herself with great perseverance in the darkness of night, without the possibility of getting at a candle, or any other source of incident light, in making a very large patchwork quilt, containing many hundreds of lozenge-shaped pieces of printed calico. She threaded her needles, and worked night after night, in her sleep, at this quilt, until she had completed it. She has, under the same conditions, written letters. She has carefully folded them, closed them with wafers, and, after writing the address, has attached a post-office stamp in the proper place. The Marquis de Puységur (see Mem. pour servir, &c.) has given the case of a countryman whom he locked up in a dark room, without the possibility of his getting at any source of incident light; and, on several occasions, this man, having pens, ink, and paper, wrote essays evincing philosophical power of thought. It cannot be contended that light was in these cases the *cause* of the faculty of seeing; unless, indeed, it was light invisible to persons in the condition of ordinary vigilance,—light emanating from the brain or nerves of the individuals in question,—certainly not light incident from sources external to the individuals. To deny the existence of such phenomena is to attempt stupidly and mulishly to arrest the progress of science. I myself have so often seen what I have related, that there can be no mistake about the matter. I have, at various hours of the night, gone upstairs to watch Jane at her operations, and have stood with the door in one hand, and, with a candle in the other, giving only sufficient light to enable me to see her at needle-work or writing during her sleep. How many well-authenticated cases of a similar kind are extant in the works of Sauvages, of Wienholt, and of others! The individual who exclaims, as some poor creatures do, "*I do not believe it*," is an object of pity, as a rude denial of the truth proceeds from vulgar arrogance,—itself the product of an ill-educated or a badly-organized brain; perhaps of one unfortunately incapable of the expansion enjoyed by refined intellects. It is not contended that clairvoyants see without light, but that, seeing with a light emanating from themselves, the ordinary definition of this imponderable is not sufficient to enable us to form a clear idea. The difficulty of defining light is not denied, for truly we are lost in our conjectures and speculations as to its essence. How much of light or of lumine is there in what we call darkness or opacity? We say that light radiates in all directions from luminous bodies. We think we know that, in homogeneous media, it moves in straight lines; that, however great its velocity, time is necessary for its journey from one point to another; that, *all things being relative*, the relation of light to time and space, under present circumstances, is very nearly that of one second to 200,000 miles. We are aware that when, during its passage, light meets with any obstacle, its direction and quantity are modified by creased the odic current at the opposite negative pole of the magnet, but without increasing in the least its magnetic power of supporting iron;

the nature of the obstructing medium.* If it be incident on a smooth and polished surface, a portion of it is reflected or thrown off from that surface at an angle equal to the angle at which it impinged, and that then it again follows its course in a straight line. The nature of the surface on which the light impinges, together with its angle of incidence, determines the quantity reflected. Supposing a beam of light, having an intensity to be represented by 1000, to fall on water, so as to make an angle of incidence equal to 0° 30″, the intensity of the reflected light would be represented by 721. If the angle formed at the surface of the water were 15°, the intensity of the reflected light would be reduced to 211; at an angle of 30°, to 65; at an angle of from 60° to 90°, to 18. Mercury, an opaque body with a very bright surface, may not reflect more than three-fourths of the light incident on it even at a very small angle.

Light, regarded as subject to laws regulating its reflection, must arrest the attention of deep thinkers; for in this fact alone of the subtraction of some degree of its intensity, much is left unaccounted for. But how vast a field opens up when we regard the laws regulating the refraction of light; or the deviation which occurs when a ray of light, having travelled in a straight line through one medium, enters another of a different density. The divergence from its original path develops phenomena, which, however wild the idea may appear, would seem to warrant the speculation that there may exist crystalline forms of lumine. It is not the purpose now to follow up the elements of dioptrics, to trace the philosophy of the refractive powers of different media, their influence on the *dispersion* of light, their powers in determining the relations of the primitive colors, although this last part of the subject has an intimate relation to the chemism of light proper or lumine, and to the unexplored field of the influence of color associated with various crystalline agencies on the human organism under the condition of mesmeric clairvoyance,—a subject which must be studied in order to liberate from its crudities the relations of the *interference* of light to the theories proposed to account for its nature. It is impossible to conceive of the extent to which scientific knowledge may be corrected, when a just faith is established in the laws regulating phrenological and mesmeric science. Philosophers have labored hard to account for the extinction of light under the laws of its own *interference*,—a phenomenon most remarkable, but one not more calculated to arrest attention and to excite inquiry than the fact established by Macartney of the "luminous exhibitions of living animals being not



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* My friend Mr. Crosse, of Bromfield, has devised a very pretty illustration of this fact, which at once exhibits the modifications effected by an obstructing medium on light, and the material nature of this imponderable agent. He takes three sufficiently strong cylinders of glass, properly capped with brass, and furnished with convenient stop-cocks; each cylinder being at least sixteen inches long and five inches in diameter. These are each first placed in relation with an air-pump. Then A is to be exhausted by the greatest power of the pump; B to a degree sufficient to give *one inch* greater pressure of the barometric gauge; C to give *two inches* greater pressure than A, and *one inch* greater than B. They are to be screwed one on another, A being uppermost. An electric shock is to be passed through the whole, from A downwards, in the dark. A will appear filled with one uniform cylinder of purple flame; B with parallel columns of a reddish purple flame; and through C will pass a falling star.

it was an addition of (*sit venia verbo*) Biod to Magnetod; and the result was doubled odic flame. *And in the present experiments the hu-*

only independent of all foreign light, but being frequently destroyed by" the impingement or incidence on these animals of any foreign light.

"I have always found the shining of the Medusæ," he says, "to cease upon the rising of the moon, or at the approach of day; and, when out of the sea, I never could excite them to throw out light until they had been kept for some time in the dark; all the luminous insects likewise secrete themselves as much as possible during the day-time, and go abroad only at night." An exception to this general fact occurs in the *Scolopendra electrica*, which does not shine unless it has been previously exposed to solar light. The chemist who observes that camphor appears to require the presence of light for its crystallization has only to try Mr. Crosse's experiment of endeavoring to form, by means of electrical aid, crystals of sulphate of strontia in the broad glare of daylight. He will inevitably fail; but in the darkened cellars of the house at Bromfield there has been great success in crystallizing this substance. In the experiments of the Baron von Reichenbach, the darkened chamber gave him results which appear incredible to persons who have not faith in the goodness of the Baron's character, or who have not reflected on the strong analogies of phenomena previously observed by other philosophers. The electric relations of the Scolopendra may in some measure account for its aberrations from a norma; and this consideration introduces a difficulty in tracing the laws relating to the luminous properties of animals, of no mean importance, derived from the modifications which complicated organisms may introduce into the associations of imponderable agencies.

If we consult the essay of Dr. Coldstream (Todd's Cyclopædia of Anatomy and Physiology, vol. iii. p. 197, article Luminousness, Animal,) we shall find that, according to the observations hitherto made, "the animals which possess the property of emitting light are almost entirely invertebrate, and chiefly marine." Those which manifest, constantly and distinctly, this function, belong to the Mollusca, Crustacea, Insecta, Myriapoda, Annelidá, Echinodermata, Acalephæ, Zoophyta, and Infusoria. Though nearly seventy species among these classes have been observed to emit light, it seems that the color of the light, with exceptions easily accounted for, has belonged to one or other of those named primitive by Tobias Mayer, and since acknowledged to be such by the reasonings of Sir David Brewster. The same animal may at different times emit different colors, and of different degrees of intensity. The Pholas dactylus has been observed to shed a *bluish white light*. In the Lampyris noctiluca the light has been observed to be greenish with a shade of blue,—the green owing, probably, to the yellow rings of integument covering the light-emitting organ of the insect. The Elater noctilucus sheds a green light, with spots of "the most beautiful golden blue." The Fulgora pyrrhorynchus emits a deep purple and scarlet light. In the marine animals, the light is of various shades of blue. The Lampyris italica, the glow-worm of Italy, emits *bright blue light*. A curious phenomenon attaches to this, as well as to another beetle in New Holland, that there are alternate emissions and extinctions of light, apparently synchronous with its circulating current, visible in the wing-cases of the insect. Have these any relation to the polarities derived from the crystalline spheroidal or globular molecules of the circulating fluid? The Baron von Reichenbach's discoveries, backed by the aid of mesmeric researches, tend to the hypothesis that crystalline light belongs to the odic properties of organized beings.

In the sea of the Straits of Malacca, near Penang and Queda, I have re-

human hands did exactly what crystals had done in the last experiments.

peatedly but coarsely examined the minute Medusæ scintillantes, and can fully testify to the accuracy of the account given by my old friend Mr. Langstaff, quoted by Dr. Macartney at page 269 of the volume of the Philosophical Transactions for 1816. If, while in a boat passing through a surface of the slime covering the sea, some of this substance be caught in the hand, sheets of light will be perceived wherever the fluid mucus is spread over the surface of the skin; and sometimes numbers of the medusæ, most of them not so large as a pin's head, may be distinguished; at others, the quantity of slimy fluid will preponderate, with little or no evolution of light. I never could bring myself to believe that the masses of light I have so often witnessed, on the milky surface of a tropical sea, were wholly owing to the shining of the tentacles of a few animals like Thaumantias Hemispherica, though in a different kind of night, when the milky slime is not present; but when the sea is unusually clear, and its depths are magnificently studded with those beautiful jewels with which Nature adorns her in the shape of the luminous Holothuria and other Mullusca, in thousands, and when Thaumantias, stimulated by the moving water, send forth brilliant glittering light from its tentacles; when the bows of the ship, in rolling the salt water over, plough up, as it were, sheets of sparkling light, there is no doubt but that more than one little animal contributes its share to the illumination. Dr. Macculloch, in his work on the Western Islands of Scotland, as well as in the article Phosphorescence in the Edinburgh Encyclopædia, has, among some philosophical ideas and curious facts on luminous animals, some that are crude and ill-digested; but he has started the highly probable conjecture that there exist some marine animals which, in their dimensions, resemble some of the Infusoria; * and that these, whether in the state of spawn or fully grown, may be possessed of the faculty of emitting light; and he distinguishes with respect to the nature of the light, as appearing in two distinct forms, and in these cases apparently arising from two sources. "The twinkling appearance seems always to proceed from the animals, and to be the result of their own actions," taking place when the water is at rest. "The diffused light appears to originate rather from detached luminous matter dispersed through the water." Macculloch calls the diffused light fainter; but if he had witnessed the great variety in this respect that obtains at night in the waters of the Straits of Malacca at certain seasons of the year, he would not have arrived at this conclusion. The diffused light is often very brilliant, and may often be compared to an illuminated blue sky reflected on the water; while on other nights, the green water of the sea is seen clear at certain limited depths, if watched out of the stern cabins of a ship, "illuminated by the pale blue light, shed off numerous points, from thousands of animals of various sizes belonging to the genera Holothuria and Beroe." Macculloch, anxious to find uses for all that the great Planner of the universe has arranged, supposed that the power of emitting light belongs to the marine animals of the lower grades for the purpose of their serving as link-lights to guide other animals to prey upon them; he thought, considering the absolute darkness that exists in the ocean at eight hundred or one thousand feet deep, owing to the light of the sun ceasing to be transmitted to such depths, the luminousness of marine animals may be "a substitute for the light of the sun," and may be a means of their discovering one another, as well as their prey. It is remarkable that some philosophic minds love to wander

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* Dr. Coldstream states that many species of the Infusoria belonging to the genera Cercarea, Volvox, Vibrio, Trichoda, Lincophœa, emit light.

445. I subsequently made a controlling experiment with the healthy Wilhelmine Glaser. In the dark chamber I grasped a mag-

from the path of obvious facts to the captivating speculations of false secondary causes. All the facts tend to conclusions diametrically opposed to those calculated to infer a wisdom for God other than his own. The greatest brilliancy of light, a point on which Macculloch insisted, is given out by those very inferior animals that scintillate their flashes on the surface, and give out no light in the deep. The numerical proportion of those that shine in the deep, and those at no great distance from the surface, bear a very trifling ratio to the scintillating medusæ. Dr. Macculloch was more exact when he stated that he had himself observed the luminous property in certain fishes, the larger and more perfect of the marine animals. "I have hitherto observed it," he states, "only in the pilchard, the sardine, the whiting, the mackerel, and the gar, but have little doubt that it is far more widely diffused. It has been remarked, by different navigators, that the genus Squalus shines at night; and the flying-fish has also been observed to emit a pale light, which Captain Ross compares to that of the moon." "Great flashes have been described as seen at a considerable depth in the sea, a phenomenon which I have often witnessed among the Western Islands:" after the observations on the sources of fallacy in such matters, he concludes that there is "the probability, however, that fish actually possess the luminous property, which is strengthened by our knowledge of the light they so readily yield after death; a phenomenon by no means connected with putrefaction, but independent of that process;" a point Dr. Hulme had long ago established. In traversing the ocean I have seen several fish caught, which, while dying, have exhibited numerous changes in their hues of color, and I have inferred that the organized vital surfaces, capable of dissecting or of evanescently crystallizing incident light to such a remarkable extent, might under other circumstances possess the power of emitting their own light. Dr. Macculloch has stated the fact that "if a noise be made by striking the gunwale of a boat when a shoal of pilchards is under it, the whole will in an instant become luminous, exhibiting the splendid appearance of a continuous sheet of light, momentary, but renewable on repeating the same alarming sound. Notwithstanding this direct testimony, it is right to observe that Dr. Coldstream has hesitated to admit fishes on the list of truly luminous animals. Dr. Macartney, before Dr. Macculloch's time, had withheld his assent to the fact, repeatedly asserted. Again, the analogies afforded by the investigations of the Baron von Reichenbach may be indicated, and the probability hinted at that Dr. Macculloch was right.

It is possible that animal light may be emitted, under certain circumstances, by all organized living beings; but the question as to whether there exist varieties in the power of exercising an animal function, or of manifesting such a property as belonging to vital structures, is quite a different affair. Certain mollusca, and some of the species of elater, appear to shine without intermission. In Italy, and in various parts of the tropics, the illuminating powers of this insect, the fire-fly, is so great that I have known a beautiful star-like picture produced by enclosing numbers of them in meshes of thin black crape, which was thrown as a veil over a lady, who desired to appear in the character of Night. In the West Indies (particularly at St. Domingo, where they are abundant), Dr. Coldstream states "that the natives use them instead of candles in their houses. They also tie them to their feet and heads in travelling at night, to give light to their path through the forest." But most of the light-emitting animals appear to use their peculiar function only occasionally, and in most instances under the stimulus of netic bar eight inches long in my own hand; when I did this below, at the southward pole, with my right hand, the blue northward flame

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some exciting cause. One remarkable fact, that is striking in its analogies, appears to be dependent on temperature and climate. The greater number of luminous animals are found in warm climates; and though among the marine animals some are seen in all latitudes, even the coldest, yet these are not so numerous, and their light is not so splendid. It is well known from the concurrent testimony of all voyagers, that they are more abundant and shine with greater brilliancy in tropical regions. The glowworms of temperate countries shine only in summer and autumn. In England it is found between June and September. It seems that "no aerial insects give out light under a temperature of about 50° Fahrenheit and upwards; and the higher the natural temperature, the brighter is the light emitted." But whether the animals be insects or belong to marine families, changes in the state of the medium in which they live, derived from altered conditions of temperature or of electricity, appear to affect them manifestly. I have myself seen sudden changes in the appearance of the surface in tropical seas, which have gone off in the course of half an hour, occasioned by the appearance of luminous animals, which have retreated as suddenly as they appeared. During the rainy monsoon, a few degrees distance from the coast of Malabar, at midnight, the weather being cloudy, and the night very dark, Captain Horsburgh saw the sea suddenly assume a milky white appearance, and then a flaming color all around: a similar appearance occasionally occurs in the Banda Sea.—(Macartney's Paper.) On these occasions, various observers have testified to the suddenness of the changes that have occurred either in the atmosphere or in the water. Before storms it has frequently been observed that the marine luminous animals are excited to give out their light with unusual splendor. Dr. Macartney, in experimenting upon the light of the medusæ, placed some of the individuals of Thaumantias Hemispherica in a glass vessel, and passed shocks of electricity through the water. At the moment, there was no appearance of light, but immediately afterwards they shone like illuminated wheels for some seconds, and with greater brilliancy than before. Humboldt corroborates this fact. It appears that the condition of an electric circuit is essential for the production of an increased light in glowworms; for Macaire, quoted by Dr. Coldstream, found that one pole only of the galvanic battery produced no effect. I have been led to infer that there is an induced imponderable agency from the closed circle of a single electro-dynamic coil, as illustrated by certain mesmeric phenomena, which, in very susceptible cases, are rendered evident by that agency. It would be very interesting to communicate this agency to glowworms, and to fluids in which marine luminous animals were present.

It is fashionable to sneer at isolated facts, and to withhold belief from any which appear extraordinary, and that can be accounted for only by the hypothesis of the existence of unknown or unexamined imponderable agencies. Dr. Coldstream must have attached a certain value to "an extraordinary series of phenomena," connected with a particular display of the luminousness of the sea," which were reported by Mr. Henderson in a paper published in the first volume of the Transactions of the Medical and Physical Society of Calcutta. In the year 1821, on the fifth March, Mr. Henderson was on board of a ship in the Atlantic (lat. 2°, long. 21° 20′ W.) and about nine P. M. the sea became "unusually luminous. Every person who kept his eye fixed upon it, but for a short time, was immediately affected with giddiness, headache, pain in the eyeballs, and slight sickness. Although these symptoms varied in intensity amongst the specat the top grew to twice the size; when I did it at the opposite, the northward pole, with my left, the odic flame at the free southward

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tators, yet there was not one on board who did not feel some degree of them; and all imputed them to the effect of the light proceeding from the surface of the ocean." Mr. Henderson remarks, "For my own part, the headache, &c., which followed immediately on my looking at the water, was particularly severe, nor did it go off until morning. The effects I experienced were like those produced by smoking too much tobacco." Although this be an isolated case of the physical effects of very intense light from this unusual source, I do not hesitate to give full credence to Mr. Henderson's statement. Having resided in Calcutta, where, at certain seasons, the light of day is most intense, and where the *repulsive agency* of this imponderable may be associated with other nocent powers, I have repeatedly suffered the illness so well described by Mr. Henderson, on the too sudden admission of the glare into my sitting-room, or on going out, too suddenly, from a darkened house, into the fierce light abroad. *Repulsive* sun-light, as well as heat, is no unusual source of the biliary derangements of India.

We are apt to be startled by relations of things that are new to us, and the repulsive agency of certain organs in the brain is, in some persons, called into operation. In standing on the defensive, it is sometimes a property of our structures that we should become offensive; and in refusing belief to things thought to be unusual, our self-esteem, and love of opposition, and cunning, and jealousy, and envy, derived from love of possession, the true gluttony of selfishness,—our cultivated obstinate vanity, assuring us that in piggish skepticism resides the philosophy which really buds only from the highest and most delicate organization, not allowing us to perceive how frequently we become illogical, teaches us to reject truths presented to us by our fellows in the best faith of their sincere feelings. I could mention the names of men, having high reputations in the world, who either have forgotten that love of justice which belongs to conscientiousness, and that love of truth that belongs to high moral natures, or who have labored under such obliquity of intellect as to have been unaware that, in some cases, the arriving hastily at disgusting conclusions is the characteristic of the narrow intellect of low-bred blackguards, and not of polite gentlemen. But the charity that springs from a conviction of man being the creature of his organization, and the circumstances which impel him to his actions, covers such beings with the pity that falls to their share. Why should the relation of an extraordinary fact like that stated by Mr. Henderson not be believed? It could not have resulted from fancy, although our judgment might truly lead us, in reading Mr. Bonnycastle's glowing accounts of the "blazing sheets of *awful* and most brilliant light" exhibited by the marine animals in a certain portion of the ocean, and in describing "many large fishes darting about *as if in consternation* at the scene," to the conclusion that in describing a truth, the author, being a person of ardent temperament, had given a fanciful coloring to his picture. So, if we had often handled light-emitting marine animals, and had never experienced an odor at all similar to that perceived around a highly charged electrical apparatus, we should hardly be guilty of philosophic stupidity, or of a want of good breeding, if we adjudged Messrs. Quoy and Gaimard to be occasionally influenced by fanciful ideas.

The fact of the luminosity of certain animals being admitted, let us inquire into the ideas that have been entertained as to the circumstances on which this phenomenon depends. It will hardly be necessary to discuss the insufficiency of the facts that might be adduced to prove that luminous animals imbibe light pole was doubled. When I did the same at both poles with the reverse hands, the flames of the free extremities were dulled. Only

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from the sun's rays, and give it out in the dark; or to combat the idea, advanced by Spallanzani, that the light is produced by a kind of combustion of atmospheric air; or that of Bragnatelli, that the light is swallowed with the food, and disengaged by peculiar organs. But when we meet with the view that the light is dependent in some way on phosphoric agency, we must examine if such an hypothesis will account for all the facts on the subject. Tiedemann thinks that the luminous phenomenon is dependent on a matter, the product of a secretion: a *liquid secretion, probably containing phosphorus*, or an analogous *combustible* substance, which combines with the oxygen of the air, or of aërated water at a medium temperature, and thus produces the disengagement of light. Hence his inference is, that the evolution of light in animals is a chemical operation, and as, *on several occasions*, the phenomenon has continued for whole days, and even after the death of the animal, it ought not to be regarded as *a vital act* (Comparative Physiology, translated by Drs. Gully and Lane, i. 270.) Dr. Coldstream justly observes that this opinion coincides pretty nearly with those held by Darwin, Sir Humphry Davy, Heinrich, and some others who conjectured that a fluid containing phosphorus was secreted by the luminous organs, and shone on being exposed to the oxygen of the air introduced by respiration. Tiedemann, notwithstanding his high reputation, must be regarded more as an observer than as a correct thinker, and it is owing to the natural homage man is apt to pay to great industry, that the capacity of his mind has been overrated. One has only to read both sides of the controversy in which he was engaged with Gall, to estimate those mental forces which belong to the close, the logical, the clear and correctly reasoning head, and those qualities which distinguish the mere observer and collector of facts: a character so often proudly asserting its right to reason, while the clear perception of important relations is absolutely wanting. When will man learn to be humble, and to know that he is the victim of necessity? If his brain be not formed to allow of his possessing the power of correct reasoning, of seizing the salient points of a complicated series of questions, and of elucidating, with happy illustration, the relations of a vast mass of facts, the crowding those facts together, without arrangement and without keys to their relations, is to offer them comprehensively for the purpose of reducing them to a mass of confusion. The great genius of Gall, like that of the wondrous Milton, shone in his power of illustrating truth, in controversy, when obscured by the cloudings of common minds. Spallanzani, in entertaining the idea of animal light being dependent on a combustion in the atmospheric oxygen, approached more nearly to the illogical chemical thoughts of Tiedemann. No explanation of a multiplicity of various phenomena can deserve the name of theory which is based on visionary conjecture, and which is insufficient to account for at least a majority of ascertained facts. What relations can the momentary flashes of light from the scintillating medusæ have with the combustion of phosphorus? What proof is there of phosphorus in the shining of the Holothuria, which continues for hours without emitting any luminous secretion into the sea-water surrounding it? This, and several other mollusca that inhabit the neighborhood of Coralline Islands, may be handled without the discovery of any luminous matter adhering to the hands. In one of Dr. Macartney's experiments, luminous medusæ in salt water were submitted to the heat of a burning candle. The light ceased with the life of the animal, instead of being increased by heat and flaring up, as phosphorus would have done. From all his experiments it is easy to conclude weak magnets can be used in these experiments, or the results are not sufficiently distinct. They confirmed in every respect the result of the preceding paragraph.

that, when the strongest and most constant light was present, the presence of oxygen was wanting. In no circumstances did the animal light exhibit anything like combustion, or a capability of being inflamed.

Instances have been adduced of luminous appearances on the human body resulting from a large admixture, in certain cases of disease, of phosphoric matter with the perspiration; and when luminous appearances have been observed in particular conditions of urine, there can be little doubt that the presence of phosphorus may possibly have been perceived by means of chemical manipulations. Dr. Coldstream affirms that *it is said* the urine of *Viverra nêphitis* and of *Viverra putorius* is always luminous. This may be true, and the light in urine may not improbably be owing to the presence of phosphorus; but the presence of this substance, because it may have been detected in a few isolated and quite exceptional cases, cannot be yielded as the one sole and sufficient mode of accounting for all animal light, in most instances of the presence of which not a trace of phosphorus has been discovered. Dr. Macartney's researches have established the more logical inference, that animal luminousness, emitted from animal organs, is the effect solely of the action of vital forces. But it may be asked—How, in those instances in which Macartney himself allowed the existence of a light-emitting fluid, could the influence of vital forces alone account for the presence of light? and how, in the glowworm and fire-fly, in which it has been asserted that the luminous organs may be cut out without the destruction of the light-emitting property which belongs to them? It is no argument against the existence of vitality in an organized fluid, that, for a certain time after its emission from the animal, it does not exhibit the chemical changes caused by death; nor does the mutilation of an animal of the lower grades establish the fact of death at once in all its parts. "Macaire took some glowworms that had been kept for some time at a temperature of 50° Fah plunged them into water at 55°, and gradually raised the temperature. Light was emitted for the first time at 77°, and increased in intensity until the water was at 105°. At this temperature the animals died, but the light continued until the temperature had reached 134°-5, when it wholly disappeared;" the light-emitting organs retaining their vitality for some time after the suspension of life by other parts of the animal. "When glowworms are thrown alive into water at 110° and upwards, they emit for a moment a brilliant light, and die instantly." Under the receiver of an air-pump, a glowworm emits a faded light, varying in degree of intensity as the air is abstracted, and the light is re-established as the air is readmitted. Kirby and Spence (Entomology, ii. 426) state that the luminous matter was by Mr. Sheppard removed from a glowworm. The wounds healed within two days, and the light-emitting organs were reproduced. These organs were first anatomically examined by Dr. Macartney, in whose paper appears this statement: "The only animals which appeared to me to possess a distinct organization for the production of light are the luminous species of Lampyris, Elater, Fulgora, and Pausus.

"The light of the lampyrides is known to proceed from some of the last rings of the abdomen, which, when not illuminated, are of a pale yellow color. Upon the internal surface of these rings there is spread a layer of a peculiar soft yellow substance, which has been compared to paste, but, by examination with a lens, I found it *to be organized*, like the common interstitial substance of the in-

446. A somewhat modified but essentially similar experiment was gone through frequently with the girl Zinkel. I let her bring her

sect's body, except that it is of a closer texture, and of a paler yellow color," &c. Macartney has remarked, that in the glowworm this peculiar substance is absorbed after the season for emitting light, and that its place is supplied by common interstitial substance.

In order to allow of the internal illumination being exposed, the segments of the abdomen are thin and transparent. In different species of lampyris there is a variety in the number of the luminous rings. Dr. Macartney discovered "in the common glowworm, besides the luminous substance, on the inner side of the last abdominal ring, two bodies, which to the naked eye appear more minute than the head of the smallest pin. These were sacs, containing a soft yellow substance. They were formed of two layers of silvery membrane, disposed in a circular direction, very elastic, although so delicate in structure. The light from these bodies is less under the control of the insect than that of the luminous substance spread under the rings: it is rarely ever extinguished in the season in which the glowworm gives out light, even during the day: and when all the other rings are dark, these sacs often shine brightly."

In the genus Elater, the light-producing organs, consisting of a peculiar yellow substance, are placed in the corcelet. In the dissection of the Elater noctilucus, Dr. Macartney found a "soft yellow substance of an oval figure lodged in the concavity of the yellow spots in the corcelet." A lens enabled him to establish its organic nature: it was composed of very minute lobules, closely packed together. In the Pausus spherocerus, the globes of the antennæ form the organs of light. Carradori thought that the lampyrides were enabled to moderate or extinguish their light by retracing the luminous substance under a membrane; but neither in this nor in any other luminous insect could Macartney detect an apparatus for such a purpose, and he observes that "the regulation of the kind and degree of the luminous appearance does not depend on any visible mechanism,—but, like the production of the light itself, is accomplished by some inscrutable change in the luminous matter, which in some animals is a simple operation of organic life, in others is subject to the will."

It is worthy of remark, that in all the dissections of luminous insects made by Dr. Macartney, he did not find that the organs of light were better or differently supplied with either nerves or air-tubes than the other parts of the body. Doctor Coldstream says that "the luminous proboscis or snout of the *Fulgora* is hollow, and has a free communication with the external air by a narrow slit situated near the base of the organ. Its cavity is lined with a fine membrane, between which and the outer translucent corneous crust there is interspersed a soft tissue, of a pale reddish color, arranged in lines longitudinally, which is supposed to be the seat of luminousness in this insect."

In those luminous insects, then, in which there is found a peculiar organization for the production of the light, there does not appear to be a question as to the existence of a fluid, from which the light emanates. There is a peculiar organic substance, consisting in some cases of aggregated lobules, but no proof exists as to the presence of so highly combustible a substance as phosphorus.

Dr. Macartney asserts that, with the exception of the animals above mentioned, the exhibition of light depends upon the presence of a fluid matter. He adduces the Pholas dactylus, in which the luminous fluid is very evident, and in vast quantity. Some naturalists assert that it is from the internal surface of its respiratory fingers near the poles of the magnetic bar. When she approached the collected points of the fingers of her left hand to the northward

tubes that this Pholas gives out its light most strongly, and of course secretes the greatest abundance of this fluid. Pliny is an authority that this fluid is *like* phosphorus, rendering every object luminous with which it comes in contact. Reaumur, according to Macartney, found it diffusable in water or any other fluid in which the animal might be immersed.

Macartney observed that the shining of the Scolopendra electrica was always accompanied by the appearance of an effusion of a luminous fluid upon the surface of the animal, more particularly about the head; and this fluid may be received upon the hand or other bodies brought in contact with the insect at the moment, and the light thus transferred remains for a few seconds afterwards. "*This fluid, however,*" adds the Doctor, "*I never could discover in the form of a moisture, even upon the clearest glass, although examined immediately with the most scrupulous attention by a lens. It must, therefore, be extremely attenuated.*"

The same appearance was observed during the illumination of the Nereis noctiluca, by Fougeroux de Bonduroy. (Mém. de l'Acad. des Sc. 1767.) Godehue de Riville, in the 3d volume of the same Memoirs, gives an account of a luminous animal he had seen on the coast of Malabar, where he saw the sea having the same appearance of a plain of snow which Horsburgh and others have witnessed. In experiments with this animal, he observed it to emit a blue liquor which illuminated the water for several lines. Spallanzi relates (Memoria sopra le Meduse forforische Mem. della Soc. Ital. tomo 7) that the medusa, which he examined, communicated the property of shining to water, milk, and other fluids, on being rubbed or squeezed in them. Professor Forbes, in his monograph on the Naked-eyed Medusæ, quotes Ehrenberg and others to show that the medusæ give out their light from the bulbs of the tentacles, and particularly the Thaumantias hemispherica, noticed by Macartney; and he compares the light to a garland of sparks around the circumference of the umbrella. Ehrenberg regards the production of the light as an act of organic life, and he observes that it "appears frequently periodically produced either spontaneously or by excitement, frequently as rapidly produced sparks, resembling small electric discharges. This repeated sparkling converts a *mucous gelatinous fluid*, which is discharged more abundantly during the operation, into a secondary state of phosphorescence, which continues for a time, even after the death of the organism, or after the severing of its parts."

Macartney had previously noticed that in this animal the light was given out from the same spots, and he adds, from the *centre* also. He says: "The central part and the spots round the margin are commonly seen to shine on lifting the animal out of the water into the air, presenting the appearance of an *illuminated wheel*, and when it is exposed to the water the *transparent* parts of its body are alone luminous." Forbes states that from Dionœa appendiculata, which is always a luminous species, the light proceeds from the reproductive glands. Ehrenberg found that in Cydippe pileus, and Oceana pileata, of the Baltic, the light issued from the neighborhood of the ovaries, and in Oceana hemispherica from the basis of the cirri; corroborating the idea of Professor Forbes, that "the light of the naked-eyed medusæ is developed by the reproductive and motor systems."

Dr. Coldstream says, "The luminous mucus is sometimes poured out even by very small animals in such quantity as to leave a luminous wake behind them, as in the instance mentioned by Quoy and Gaimard. These observers saw such luminous lines formed in the paths of certain extremely small creatures, so transparent that their forms could not be distinctly made out. The positions of their pole, the flames of both sides flowed towards each other, becoming more slender and larger; when she came nearer, however, they drew

bodies were marked in the water by bright spots, which were followed in their course by luminous wakes, at first about an inch in breadth, but afterwards by the movements of the water spread out to the breadth of two or three inches. This luminous mucus is supposed to be the seat also of the remarkable stinging property possessed by many of the *acalephæ*. It retains its luminousness in some instances for a day or two after being emitted by the animal, but *loses it whenever putrefaction commences*." Dr. Maculloch, who paid much attention to the subject, thought that in marine animals generally the coats of the stomach and intestines were the real light-emitting organs. Whatever differences of opinion may have existed on this part of the inquiry, it seems certain that from the momentary or from the sudden and periodical sparklike gleams or flashes, the light proceeds from the internal organs of the animal under conditions of an *exalted or stimulated vitality*, or from tentacles capable of assuming a spheroidal shape; that it would seem to depend on the agency of some imponderable; that this can attach itself to a vitalized mucus, which ceases to shine when death produces putrefaction; that in the luminous insects this imponderable does not necessarily attach itself to a palpably moist fluid; that in many cases there is no evidence of a fluid further than the presumption of a slight moisture accompanying the presence of the fatty matter belonging to the organs of light; that in some of the medusæ and some other luminous animals, there are fitful flashes of light without the appearance of subsequent trains or wakes of a light-containing fluid, affording the presumption that some stimulating influence may impel the organism in such animals to flash a vivid gleam of light which is not necessarily borne along on a vitalized mucus. It might be very logically contended that the cessation of the phenomena of light on the commencement of the process of putrefaction was a strong argument in favor of the vital origin of the light; but it is at the same time a cogent reason why the light is not necessarily connected with the presence of a nervous system. The desire to connect vital phenomena necessarily with certain known conditions of organization is a testimony of an inelastic mind, wanting the capacity of yielding, with delicacy, to numerous facts that must be ignored by stubborn refusals to embrace knowledge inconsistent with the conclusions established during the existence of a crude and unripe philosophy. An exalted state of vitality may be a necessary condition for the exercise of the functions of reproduction, but the presence of the organs of reproduction does not necessarily imply the existence of a nervous system, and the light-bearing mucus that is shed from certain medusæ may serve as a nidus for ova which escape from their ovaries. The lampyrides deposit eggs which have been said to be frequently luminous, and their luminosity has persisted for several days.

The experiments of the Baron von Reichenbach would tend to show that nature has a law of type in many of her operations besides those strictly anatomical, and the animal function of emitting light, belonging to the crystalline type, may be found to be a property of all organic spheroidal molecular matter. A strong analogy to the facts discovered and recorded by the Baron, I find in Dr. Coldstream's article, relating to the *Nyctipithecus trivirgatus*, a South American ape, quoted from a German work by Reugger (Naturgesch. der Saugthiere von Paraguay, S. 383.) This animal is nocturnal, and when the observations were made, it was under circumstances of total darkness. Reugger states that then, the luminousness of the ape's eye was distinctly seen, and the light was so brilliant, that objects could be clearly seen at the distance of eighteen inches from the back, became shorter, contracted, and both disappeared as soon as the finger-points came in contact with the poles of the magnet. But

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eye which was illuminating them. Treviranus (Biologie, i. 439) endeavors to show the impossibility of this phenomenon, notwithstanding an admission that some dogs have an analogous power of generating light within the eyes; and he thinks he grants enough if he modifies the circumstances, under which the light is perceived, to those in which impressions are made that arouse the feelings of the animal, and that betray him into the expression of some instinct or passion. This physiologist had not been at the pains to have the fact, stated by Reugger, either subverted or corroborated. Nor had the reflection upon the similarity of structure in the brain of the dog and monkey families passed through his mind. The value of isolated observations is, in philosophy, often enhanced by the curious and subsequent corroborations afforded to them by the labors of inquirers who work with quite different objects, as we perceive by the Baron's new investigations. Dr. Coldstream has very pertinently remarked, that "If if should be proved that some of the higher animals really do emit light from their eyes, independently of the incidence and reflection of that from without, it will go far to render it probable that in luminous animals generally the development of light depends more upon the movements of some imponderable agent in and from their nervous system, than upon the nature and composition of the fluids poured out by the luminous organs." Modifying the conclusions to which my revered and lamented friend Dr. Macartney, had arrived, I would seize the admissions of Dr. Coldstream as a step towards a progress in the belief of facts established by mesmerism, while I would point to the hypothesis of my friend Ignotus, as to the possibility of all lumine being subject to the laws of chemism, imponderable, in itself the minutest form of spheroid developed from organic spheroidal matter; the lowest condition of which, within our ken, is that from the crystallization, which exists in the form of pure metallic aggregation; the highest, the form of light which emanates from the human being as the result of *will* or of *thought*. In this view, of course, there is no admission of the hypothesis assumed as a conjecture by Dr. Coldstream, that the development of light may, in luminous animals generally, depend upon some agency from their nervous systems, since in many of them it would be difficult to prove the existence of such systems. As easy might it be to prove the existence of blood-vessels in the medusæ, asserted to have been observed by Will. I should be inclined to advocate the severity with which Professor Forbes rejects all unproved assertions of the existence of certain, apparently to us, essential organs of living beings. The eagerness to establish the presence of vascular circulating systems in mullusca, because, in the highest classes, more exalted vital phenomena could not exist without them, is an example of the desire to account for everything before we have sufficient evidence to guide our judgment. The logician is often heard to mix sneers with ridicule on the arguments derived from analogies. How, without analogy, are we to classify? How, without classification, are we to form categories? It is the abuse of instruments that is productive of confusion in reasoning, and of the difficulty of arriving at just conclusions. The laws regulating nutrition, as well as reproduction, have yet to be carefully studied before we arrive at final decisions as to the means by which the ends are accomplished. To a certain extent we must confide in analogy; but as events change our points of view, we must suspend judgment until more complete knowledge be acquired. The researches of the Baron von Reichenbach, as well as the daily developing new facts in mesmerism, are establishing the existence of the odic force; and the phenomena pro this did not always succeed equally well. If the magnet was small or weak its odic flame was extinguished, that of the hand not com-

duced by this power in controlling diseased growths, many of which may be regarded as subject to the laws regulating the existence of the lowest organisms, may lead, in future time, to the inference that those changes we now consider as essentially dependent on absorption and deposition, by means of a vascular apparatus, are but chemical compositions and decompositions effected by the agency of light, developed into activity from some latent form, or liberated from its association with that hitherto occult power, upon which the Baron von Reichenbach is shedding the luminous rays emanating from the crystallic arrangements of his highly organized brain.

It is unnecessary to ask the question as to the constitution of vitality; for our knowledge is not sufficiently advanced to enable us to give a satisfactory reply. Chemical changes of a certain nature are the sources of the clearest definite idea we can form on the subject. The phenomena of life are dependent, probably, upon some imponderable agencies, the nature of which, man, in the present brutal condition of his civilization, studies at his peril; for so keen is the bitterness of competition, that even the dignity of corporate bodies is occasionally compromised by the tacit countenance yielded to slander and calumny originating in the effort to distract public attention from gross private and individual professional incompetence; and men are found, with pretensions to science and to social position, who can, in their eager desire to crush the truth, utter deplorable falsehoods, and quite forget the becoming characteristics of gentlemen. It is not to such judges that the researches into the curious phenomena of new imponderable agencies are submitted. With humble assurance that the investigations recorded are put forth to the world in the philosophic spirit of justice, the virulent attacks of malice are regarded with the pity to which their authors are entitled.

The authority of Humboldt has been adduced to affix some remote probability to the idea that *dead* fish may be an occasional source of the luminous appearances met with on the ocean; for this celebrated philosopher "saw a great extent of the surface of the sea rendered almost gelatinous by the admixture of numbers of dead *Dagysæ* and *Medusæ*. We have seen that there is the testimony of Macculloch for the fact that living fish in shoals occasionally under conditions of excitement emit light. Whether, at the moment, their bodies yield a luminous fluid or not, is a question to which no reply can be given; but it is well known that the pilchard and the whiting, for a short time after what is called death, shed forth a shining light, which ceases before the truly putrefactive process has commenced. I have seen a large area of fields on which pilchards, destitute of odor, at all events at a short distance, have been spread for manure, shining brilliantly one night, and the next all was dark, when the offensive effluvium from them became quite sickening. If the fish be examined during the process of death, an oily moisture can be scraped off, which in the dark, for a very short time, is found to be luminous even on the surface of the water; but it is said that the light may be observed diffused through the water if the mass of it be agitated. Those fish which are known to become putrid soonest are those which earliest shine. In Tuckey's voyage, Professor Smith's account of his own observations made in the Atlantic corroborates those of other voyagers, that the *bright sparkling* light of the surface of the ocean is always emitted by *living* animals, and that the duller light which Horsburgh and others, as well as I myself, have seen emanating from a milky appearance on the water, pletely; in other cases the finger points were extinguished and the flame of the magnet-pole remained; this was the case with larger

is the result of a "dissolved slimy matter." Professor Smith examined this slimy fluid under a powerful microscope, and he detected "the most minute glittering particles having the appearance of *solid spherules*." In what kind of spherules can vitality be said to reside?—Not in spherules of carbonates or sulphates of metals or metalloids,—not in siliceous spheroids aggregated in rock crystal,—not in the diamond; but in those belonging to organized matter, whether in the lower or higher states of organization,—in the slime of the ocean, in which occasionally *dead Dagysæ* and *Medusæ* may sometimes be found, but in which, in luminous states, it may safely be predicated living spherules are always present: in dying fish, oil, constituted of living spherules, but which, exhausted of the presence of the imponderable agency giving it the power of shedding a light, not incident upon it, becomes dead matter, no longer having living phenomena, dead matter once organic, once crystallic; now resolved by the laws of chemism into inorganic elements. Are we to deny the existence of living spherules because we are not yet gifted with the power of distinguishing the varieties in the size of their diameters and the relative positions of their molecules? Are we to admit the probability of their existence in the slime on the ocean? in the abundant fluid from the Pholas dactylus? in the mucus shed by certain luminous centipedes inhabiting the islands of the Pacific, which, on being rubbed off by the fingers, leaves an odor behind not unlike that of muriatic acid? and to deny that there can possibly exist spherules in the *light* which Macartney wiped off from the Scolopendra electrica, and which astonished him because he could detect no moisture? In nature is there no *variety in degree* in the qualities of her phenomena? Is it not notorious that in our susceptibilities to impressions there is every variety of degree? Some can see, in ordinary wakefulness, and in daylight, the blue sparks emanating from human fingers. Some can see a blue or violet halo surrounding a person under certain conditions. Others can, in the ordinary waking state, see none of these things, but are enabled to perceive them immediately by being put into mesmeric sleep by the agency of the human will,—by passes, by pointing of the fingers, or by presenting the apex of a crystal to the face or eyes. This light so perceived is like all other light; in some cases it dazzles by its brilliancy and diffusion, or is, under other circumstances, subdued and limited. In some persons it is associated with a cloud,—blue, grey, or silvery; in others it is clear, and like the shining of the sun. Such great variety is offered by the phenomena of animal light, and so many facts to evince its intensity, its concentration, or its attenuation. Some medusæ have been known to shine with a light so intense that the human eye could not long be directed upon it. It dazzled like the sun, and yet the point whence this illumination was distributed was not, in diameter, equal to one-two-hundredth of that animal itself. Animal light, then, is manifestly subject to the laws which regulate all other matter; it is condensible and expansible, capable of being very intense or very much attenuated, according to the structure whence it is liberated. The phenomena offered by light emanating from inorganized matter are quite analogous. Varieties in degree may be traced from the light emitted by electrical agency from the points of charcoal to that emitted in the dark from the poles of the magnet. Nor are there wanting facts to show the probability of this imponderable matter, as we call it, being subservient to the laws of attraction and repulsion; and if this could be established, imponderability would no longer be a characteristic of light.

and stronger bars. The equilibrium was displayed soonest in bars of four to six inches long. But this showed itself differently with

There is a strong probability that all spheroidal particles have their polar and equatorial relations operating with *plus* or *minus* energy; capable of being modified by forces powerful enough to control them. The proofs of the existence of this probability should be offered only to minds that can admit the truths of mesmerism. To others, as they are incapable of appreciating the subtleties of fine reasoning upon subjects of an extremely delicate nature, it is a loss of time to waste facts. To pigs, to some adult agricultural hinds, to the majority of members of medical colleges, a grunt, a meal, or a sneer, would be more appropriate to their tastes and capacities. In all classes, the stupidities and the cunning sordid must be separated from the rest, that progress may not be obstructed. The Baron von Reichenbach had had the opposition of the unphilosophical to contend with in Germany, as we have here; and if he would make himself master of Gall's works, he would find many reasons to pity his opponents, and some facts to show that Gall, in his day, met with *stupidities!*

Mesmeric agencies allow us to place very susceptible and delicate subjects in such relations as to enable us to regard them as excellent tests for the elimination of facts which the state of our knowledge does not at present permit us to arrive at by any other mode of investigation. If we take a certain number of such testing subjects and obtain from them the same testimony, we may feel satisfied that we have as good evidence as if we had a galvanometer applied for the testing of electricity. If we find that in these, certain stimulants or excitants, whether applied in the form of a train of actions or in the form of the application to certain organs of the body of a magnet—a piece of pure gold, of pure platinum, of titanium, of nickel, of cobalt, or other definite substance, produce invariably a rigid condition of the muscles,—a tonic spasm, and that other stimulants or excitants produce immediate relaxation of that rigidity,—a clonic condition, we have a right to class our agents or reagents accordingly. My experience having led me to infer that tonic agencies are to be classed as attractive, and clonic agencies as repulsive, I arrive at the conclusion that that train of actions which induces rigidity in my testing subject belongs to an attractive pole, and the contrary to one repulsive. If I take a tube of glass, of porcelain, of hard wood, or of paper, and blow through it upon the upper part of the forehead of a testing subject, and produce instant rigidity, I infer that the particles of air passing through the tube have a plus polarity; a force attractive. If now I reverse the tube, and by blowing through it in the direction opposed to that of the first blast I produce an almost immediate relaxation of the rigid state of muscles, I infer that an influence was left in the tube which, on the first occasion, determined a molecular arrangement of the gaseous particles that gave them one polar arrangement—*plus*, and that on the second occasion the polar arrangement was reversed and became *minus*. If now, without the knowledge of the subject who is asleep, but in the condition of relaxed muscles, I pour on the head a phial full of mesmerized air, I render the muscles immediately rigid; and then, exhausting the phial of the air which has displaced the mesmerized air, I quickly apply it to the head, I relax the muscles and sometimes suddenly awaken the subject; thus showing that the polarity of the particles rushing into the bottle, communicated by an influence derived from the person of the subject, has been opposite to that polar state which has been productive of the tonic conditions of sleep and rigidity. But several somnambulists in another room have witnessed the filling of the phial with blue mesmeric light, so that Reichendifferent persons, and doubtless in different degrees in the same persons in different odic conditions: my own finger often extinguished

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bach's odic force has been the source of these phenomena; and the light which has been associated with that force has been subjected to the same polarities. How is this ascertained? By blowing strongly in a direction across the stream of mesmerized air while it is poured out of the phial: no rigidity is produced, and a somnambulist sees the blue light blown away from the testing subject. Light is in these cases associated with some agency that communicates a specific gravity to the air. May be a minute dose of carbon or nitrogen from the animal textures.

It may be argued in opposition to such facts and such views, that the results obtained by each mesmerizer differ from those obtained by any other person. This is a very curious part of the affair, and is an additional motive for further inquiry. It is very true that Major Buckley can make my somnambules exhibit phenomena of high clairvoyance, which I cannot succeed in producing. I can, by my will, effect several phenomena which Dr. Elliotson does not seem capable of producing; and I have at his house in vain tried to produce rigidity of the muscles in one of his patients, in whom a touch of his finger has at once effected the object. The differences between the mesmeric forces of my friend Mr. H. S. Thompson and myself, have been repeatedly pointed out. Mr. Joseph Hands had a patient (Garman) in whom he could produce several phenomena that baffled me when I attempted them. These modifications are important facts for investigation, but they do not invalidate any series of established truths. It is a fact that upwards of thirty persons, who have been in a clairvoyant state, have seen blue sparks in great numbers issuing from hazel sticks, but because not more than seven of these have exhibited the phenomenon of being forcibly attracted to a hazel stick when it has been held in the direction of its growth, and have been repelled by it when it has been held with its smaller end downwards, is that a reason why the established fact as to a highly curious phenomenon should be completely thrown away?

The relations of the subject of light emitted from the hazel stick and from some other vegetable organisms to that of clairvoyance, are curious and important. In a previous note I have endeavored to call attention to this point. Lately I have had opportunities of making experiments upon an analogous set of phenomena relative to the influence of odic light emanating from water, from glass, or from crystals, upon the nervous systems of certain sensitive persons, which tend to illustrate clairvoyance. They are so easily repeated that time only is required for thousands of corroborations of the events I have noticed; and although we have in England many *stupidities*, who, like the Baron von Reichenbach's critics, will carp at facts, which their maladroit minds will turn to ridicule and calumny, the simplicity of the apparatus required for these phenomena will speedily ensure a sufficient number of verifications. The persons who form the subjects of these experiments should be of highly sensitive nervous systems, and, as far as I have observed, should have heads well developed about the organs of ideality, marvel, veneration, and hope; comparison, tune, time, and constructiveness; adhesiveness, philoprogenitiveness, and caution; and rather the contrary as respects amativeness, combativeness, self-esteem, cunning, and acquisitiveness. A phial of clear colorless glass, capable of containing eight, ten, twelve, or more ounces of filtered water, or a clear globe holding a pint and a half or a quart of water, answers the purpose well. The vessel should be completely filled with water, clean and clear. It should be mesmerized by some healthy person with a large the same magnet which that of Zinkel would not wholly put out: this was equally the case when her finger was more strongly luminous

brain, by darting the odic sparks from the fingers upon the surface of the water, at several hundred strokes, and by breathing upon it for some minutes. The vessel should then be closed, so that no bubbles of air are admitted, and when properly secured, should be placed in the hands of the sensitive person, who is to look continuously into it, uninterrupted by the proximity of too many persons, whose odic forces may tend to spoil the experiment. The mesmerizer of the water may be near, but it is better that not more than one or two persons besides, agreeable to the sensitive person, should be present. I have placed vessels of water so prepared in the hands of numerous sensitive persons, most of them quite unaware of the object of my requesting them to look steadily at the water. Some, in the course of a few minutes, have seen beautiful visions of persons and things that have given them delight. Others have seen objects which have terrified them. Some have described, vividly, charming country scenes, with elegant companies of ladies and gentlemen gaily attired, at boat races on a river. Others have seen hunting gentlemen, in scarlet uniforms, on fine horses. Some have seen funerals and churchyards; others, sick rooms, with death's heads flitting about the surface of the bed of sickness. Some have truly predicted to me the approach, to the house, of friends, who were to knock at my door at stated times. On one occasion, a visit from my friend Mr. Hoffmann, of Mayence, was predicted by a person, who described him accurately without ever having seen him, except by the agency of the crystalline bottle of water, which she then held in her hand for the first time in her life, and without knowing the object I had in view in requesting her to look into it. At the moment I had a conviction that Mr. Hoffmann was either at Macclesfield or at Liverpool, but he made his appearance in my room in ten minutes,—the time my sensitive subject had indicated. A number of people have now repeated such experiments, and I am told that several persons who had failed, at first, in perceiving anything in the vessels of mesmerized water, had, by dint of patience and perseverance, after many repetitions of trials for half an hour and an hour at a time, become highly clairvoyant. If my health and my various pursuits had permitted, I should have instituted many experiments upon this subject with vessels of glass of various colors, and containing fluids of various compositions. The curious facts that have excited so much attention in relation to a crystal ball, bought by Mr. Morrison at Lady Blessington's sale, and those relating to the numerous fits of clairvoyance induced in Mrs. Woodard, by her looking into an oval piece of polished glass, are analogous to those I have stated. The *stupidities* rely, in opposition, upon the numerous failures that occur in the attempts to repeat the exhibitions of these phenomena. If it were possible that such persons could practise humility, I would refer them to the study of the Baron's researches, in order to prepare them for a proper spirit of investigation. After witnessing very numerous instances of clairvoyance, I can have no doubt but that the brain, apt for the purpose, is stimulated to the production of the phenomena by some relation which it bears to light; perhaps to this imponderable matter in combination with the odic force. What that relation is, must be determined by future investigation. Why certain individuals should feel the influence of currents of water to be highly pleasurable, and others should shudder at them; why running streams, and mountain rills, and sheets of falling water, should have such powerful attractions for some, and be indifferent or even repulsive to others, are questions that have relations to the phenomena of mesmerism, odic forces, light, and clairvoyance; perhaps to the theories enter-than mine, which occurred not unfrequently. She was tall and stout, but had small hands, in which the result was concentrated, and thus

tertained by our greatest philosophers on the essence of light. The most extraordinary of clairvoyants, Andrew Jackson Davis, the American, has spoken of the existence of unparticled matter, as Huygens and his followers have thought of an elastic medium. It is admitted that philosophers should not seek for too many facts to account for a satisfactory result: a surplus of truth would appear unnecessary. The human mind has the capacity only for a limited quantity. Among the ideas it cannot embrace is that of space being filled with particles, and still requiring the existence of an unparticled or an elastic medium in which to contain these particles. Why is not the elasticity of the myriads of infinitely minute molecular spherules, attenuated to the requisite *degree*, sufficient to fill up space without leaving vacuum? Constructed as we are, the organization of the brain is incapable of framing the idea of a vacuum. If pumps could be constructed to remove from a scooped ball even the imponderable matter which occupied its internal area, the noun space would remain, and it is impossible to make nonentity of that. But space in itself must necessarily be made up of an infinite multiplication of points,—"of nothings," some mathematicians would reply. He who would intrude such a thought must have a confused idea of the relations of numbers to matter. All is ratio. All elements, all forces, are *plus* or *minus;* and however subtle may be the power of ratiocination in any man, his brain is quite incapable of conceiving of the multiplication of any definite surface without the idea of increase, or the sense of thickness; or of the multiplication of a line without the idea of increase relative to the sense of width. The negative series of decimals can never come to absolute nothing. A mathematical point, however minute, is susceptible of multiplication, as well as attenuated matter of further division of attenuation.

The difficulty in allowing of the complete occupation of space by most extremely minute molecular particles, arises from the limited nature of our organs; and very few philosophers have been at the pains of obeying Locke's direction on the examination of the degree to which habits of thought have influenced their assent to the adoption of a theory. If I place Jane M. or Mary D. on a couch or in a chair, and imagine a circle around that couch or chair, silly people would say that I had environed the individual by a magic circle, for she has not, until I remove that imaginary circle, the power of moving from the position in which I have placed her. I am told by clairvoyants, and by the subject herself, that the circle is one of blue flaming light. If this be so, the light has resulted from an operation of certain organs of my brain; and whether it has reached the floor, on which it is perceived, by the transmission of a certain number of spheroidal molecules from my brain, or that the brain has communicated an impulse to certain pre-existing undulatory elastic matter, the effect is the establishment in that circle of a force which directly influences the subject. That light and that force have remained for hours, on repeated occasions; and Jane has, when afflicted with serious delirium, been calmed at once by my will, and has remained quiet in bed the whole night, under the influence of the luminous circle. When I perceive the fact of so highly attenuated and subtle an agent as a flame of light from the brain, issuing to a circular line, remaining there, exerting a power over the organic operations of another individual, I find it difficult to bend my habits of thought to assent to the proposition, that that circular flame is undulatory elastic matter exerting a force which reverberates on Jane. It is easier for me to embrace the idea that the light is composed of very minute spherules, which, by appeared with more intensity. When, however, she carried the points of the fingers of her right hand towards the northward pole of the bar, there was no attenuation, no approach of the flames; the like-named poles did not attract one another. As the approximation was carried further, the flames both became contracted at their own poles, assumed a globular form, and finally were partially introverted when the fingers and the poles came in contact, but both flames were at the same time in a diminished, dull condition. At other poles the result was exactly the same in the reverse order. But the multifariously modified experiments prove the same thing; namely, that *the points of fingers act upon the polar odic flames like crystals and like magnets, and may in all cases be substituted for them.*

446. *b.* The variations just mentioned, produced by unequal strength of the reacting odic poles, went so far, that in one particular case I found the polarity of the odic flames of a weak magnet directly reversed by powerful hands. This observation merits attention, because it affords a further proof of *the independence of Od in contrast to magnetism*, similar to that which we had just now at § 436. I gave to Josephine Zinkel a magnetic needle four inches long, which was not strongly magnetic; she held it by the middle, between two fingers, conformably in the meridian. When I took hold of its positive end, turned toward the south, with the points of the fingers of my right hand, the blue odic flame at the other pole of the needle became twice as long as it was originally. This great increase proved the weakness of the needle in proportion to my hand.

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attractive affinities not yet understood, except in so far as the researches in the text are elucidating them, have a relation to certain forms of animal light residing in the nervous system of another human being. Undulations and curves, necessary conditions, requisite paths, for the passage of even the most attenuated fluids through one another, are convenient ideas, as expedients, to enable us to apply calculation to the relations of dynamics.

To apply the words spiritual and immaterial to the class of phenomena under discussion, is to remove them from the domain of physics into the region of the absence of ideas,—into a territory in which the existence of non-entities must be affirmed. The instant the human mind loses the idea of matter, it wanders in a haze in which clear consciousness is no longer present,—it approaches, in a degree, the state to which narcotics reduce the perceptive faculties, and which, carried to its extreme limits, proceeds to fatuity and unconsciousness,—a condition incompatible with immortality, and thus involving an absurdity. One can conceive that however light may be hidden by combination with other forms of matter, it may reappear, but can never be annihilated as long as space exists. For all we know, its destiny may be immortal; its nature may be to become infinitely attenuated and purified. But whether it exists associated with heat, electricity, magnetism, chemism, or odism, the mesmeric facts of clairvoyance show that it is the vehicle in which thought is conveyed, and may be the punctum saliens of the lowest animated spherule, as well as of the higher organized being.

But when I took hold of the positive end of the needle with the tips of the fingers of my left hand, the blue color of the northward flame was lost, and a red flame half the length took its place. When I made the experiment the other way, and put the tips of the fingers of my left hand to the negative end of the needle directed to the north, the red flame at the other pole became more luminous and three times as long. But when I took hold of the same negative end of the needle with the right hand finger-tips, the red color of the southward flame was lost, and a blue flame took its place. It clearly results from this that the odic force of my hands far exceeded that of the weakly magnetic needle in reference to odic polar quality; so much so, that it converted its red or blue polar flames into blue or red, when its Od was opposed to that of the magnet at the other pole, *and without in the least disturbing the true magnetic polarity of the ends of the needle.* My hands, which possessed no magnetic capacity whatever, acted so strongly odically upon the needle, that its Magnetod was completely overcome by Biod, and the flames changed color. (It acted exactly as we have seen electricity act.)

447. In contrast to these means of strengthening the odic flame, I have become acquainted with *means of weakening* it, and as yet with two. The first is *Heat*. I showed Miss Sophie Pauer a horse-shoe in the dark; she found its polar flames from two to two and a half inches long when cold; when I had warmed it to the heat of one's hand on the stove, she found the flames diminished to about four-fifths of an inch. And when the magnet had cooled down again, she found its odic flames of the same size as at first. On the following day I repeated the experiment with a larger magnet: I raised the temperature to a rather higher degree; she again saw its flames diminish considerably in size as it became hot, and increase again in proportion as the cooling progressed. Wilhelmine Glaser, in the dark chamber, saw a polar flame of six inches length on a single horse-shoe with limbs ten inches long, as long as it was cold. I laid it upon the heated stove, and when it had reached about 100° Fahr. I brought it to her again; she now found its flame diminished to about three inches. I placed the magnet on the stove once more, and heated it to about 144° Fahr., so that I could no longer hold it well in my unprotected hand. Now, when I brought it to her again, she saw the flame reduced to an inch and a half. But when I had let the horse-shoe cool down, with the armature applied, the flame was as large as it had been originally. Josephine Zinkel made similar observations on the same horse-shoe magnet. The diminution of the odic flame appeared to her more strikingly in bars; when they were heated, the luminosity almost entirely disappearing. Accordingly as

the odic incandescence of magnets is diminished by elevation of temperature, (§ 369,) so also, and in a more remarkable degree, is the odic flame; by heating steel magnets to a little above the boiling point of water, the flame would perhaps be wholly extinguished. It consequently diminishes far more rapidly in steel, with the increase of temperature, than the magnetism, which indeed also sinks, but far more slowly.

448. A second cause of diminution of the odic flame lies in another circumstance, of much more importance to the experimenter, namely, *the proximity of surrounding objects.* We have already seen what crystals, hands, and the like, can effect; I shall discuss the influence exerted by metals, metalloids, alkalies and acids, brought in considerable quantity into the vicinity of flaming magnets, in the chapter on the light of matter. I shall here only speak of the remarkable *influence of approaching persons.* Miss Atzmannsdorfer often observed to me that she only saw the magnets I showed her well, when I removed to some distance from them, and they were not too close to herself. Madame Kienesberger called my attention to the fact, that, when occupied in making a powerful electro-magnet, I came too near it, its odic light became bedimmed and diminished. Mr. Hochstetter, when I accidentally went very close to an upright magnetic bar, the flame of which rose six inches high, found this disappear wholly from his sight, and reappear as soon as I had moved away again. To control this, I placed the nine-layer magnet conformably with poles upward, upon a table; he saw it flame up about a foot high. As I then approached the magnet, the flame became weaker; and when I came quite close, so that my body touched its top, it entirely disappeared from his view: he saw nothing but the incandescent steel. When I moved away a step, it was restored, and I could repeat this as often as I wished. Dr. Nied saw exactly the same with the nine-fold magnet standing on a chair. In like manner, also, Mr. Delhez and the Baroness von Augustin. Mr. Pauer saw odic flame flowing from the nine-fold magnet in the dark chamber. I walked slowly towards it; when I had come within about half a foot, he saw the odic flame become dull, and when I was quite close to the steel, the flame was wholly lost to his sight. His daughter, Miss Sophie, witnessed this strange phenomenon at various times. She saw smaller magnets as well as the nine-fold always first grow paler, then lose the flame as I approached them, and in each case it was restored as soon as I drew back from them. Wilhelmine Glaser frequently perceived my approach produce extinction of the odic flame on the nine-fold magnet, and even when it had recently been rubbed, and its magnetic intensity was at the highest pitch.

But when I drew back only a little way from it, it immediately began to form again, and was wholly restored when I had removed to the distance of a pace. Madame Bauer frequently communicated this observation to me unexpectedly: when I accidentally approached the odic flames of magnets under examination, during the course of experiments, she complained that I came too close to them, dulled, diminished, or extinguished the flame by my proximity, which interfering with her observations about what I was asking her, she warned me to move away. Josephine Zinkel explained to me that when my immediate proximity had weakened the flame of the nine-fold magnet down to invisibility, my retreat did not restore it directly, but only gradually: and it was requisite for me to move to the distance of about forty inches for the flame to reacquire the full strength of its light, and my vicinity to become quite imperceptible in the appearance of the flame.

449. In order to master this deceptive phenomenon, I instituted the following experiment. I placed the large nine-fold magnet vertically, with its poles turned upwards. I then turned the northward limb to the east and the southward limb to the west; and another time the former to the west and the latter to the east. In the dark chamber, and in the presence of Josephine Zinkel, I slowly and alternately approached and removed from both poles at once on the north side, with my face toward them. As soon as I came near, the flames were extinguished on both poles, and restored directly I removed again. When I so modified the experiment that I approached only my right side to the two poles, their flames were no longer both extinguished, but only one, namely, the northward blue flame; the southward red flame became brighter and more intense in its redness and luminosity. When, on the other hand, I approached both poles with my left side, the reverse occurred; the southward pole lost color and luminosity altogether, while the northward very much increased in blueness and intensity of light. This made the matter clear, and brings it under the regular law.

450. It is, therefore, the odic quality of the entire person which reacts as strongly upon a magnet, even on a very powerful one, as magnets do upon each other, and especially with their like poles. We have seen how these act upon each other, depressing and extinguishing flame, and the biodic poles also act and react upon the poles of magnets, even when we cannot at all, or at least as yet not in every case, clearly state where the animal poles exactly lie in the particular instances, and which or what of the many complicated odic axes of the body it actually is which causes the observed extinction. But a cautious investigator will perceive here a boundless source of count-

less errors, countless misconceptions, countless incomprehensibilities and enigmas, which up to this time have pressed like a mountain upon the so-called animal and mineral magnetism, and without the removal of which it is clear that normal and harmonious observations cannot be attained. Every physicist saw something different, and each met every day with something different from what he saw the day before; nay, during one and the same experiment, the results were modified under the hands of the investigators as they changed their positions or their assistants, and as the number of bystanders increased. They were unaware of the cause, never knew how to attain a fixed point in the experiments, the scientific ground trembled everywhere under their feet, and the complications ran out into infinity.*

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* May my good friends, the doctors and professors of the self-styled commission, take warning, and not merely learn to perceive the weakness of their experiments, but also to feel the disgrace they have brought upon themselves by their groundless accusations against poor Leopoldine Reichel. They made a dark chamber, of which they themselves relate that, in their haste, they stopped the crack of the door with pocket-handkerchiefs. (Zeitschr. der Gesellschaft der Aerzte in Wien, III. Jahrg. 138.) Whoever has worked long in a dark chamber, can imagine what kind of darkness it could have been that was improvised in this manner! In the narrow space of a small room, the sensitive was crowded constantly with ten to fifteen young men, and some of these *went out and in* every now and then (*loc. cit.* 119 and 139.) We know that the momentary penetration of light, even only through the smallest crack, renders the eye *dazzled and almost insensible to odic light* for more than half an hour; and here we have, as at the beginning, the rude effect of opening the door for persons going out and in! This alone is more than sufficient to render the results of such clumsy experiments wholly useless and valueless, and to make any deduction based upon them altogether ridiculous. If Miss Reichel saw nothing under such circumstances, as the accounts frequently declare, she told the truth, because she *could not* see anything under such perverse arrangements, not because she did not possess the capacity, but because ignorantly arranged experiments rendered it impossible to her. Finally, however, she did see somewhat, gave confused statements, and on this account was called a liar and a deceiver. Let us examine the statements of these gentlemen, and see where lying and deceit are to be found. Leopoldine Reichel was placed at a distance of three to six paces from the magnet, there was usually a doctor on each side of her, who were appointed to watch over her, and they frequently held both her hands. Opposite to her sat another doctor, holding a heavy horse-shoe magnet in his hands upon his knees, and moving it about. Close to him, in like manner, at each side, sat a doctor, directed to control the movements of the magnet. The sensitive was now to state how and where the magnet was luminous, while it was being moved up and down; they pressed her to show her art, laughed at and mocked her when her statements were incorrect, irritated and angered her to such an extent that she more than once struck at the gentlemen, and once was in the act of boxing the ears of one of them, &c. In the first place it is impossible that a moderately sensitive person, as Miss Reichel was at that time, could perceive any magnetic light in a darkness which was continually interrupted by the entrance and exit of spectators. In the second place, the distance of three to six paces from the magnet is far too great;

451. The odic flame, as we see, affords no conclusions as to the direction of the magnetic force; to express myself in Mr. Faraday's words, no lines of magnetic force make their appearance in any odic phenomenon. In order to get some evidence on this point, if possible, I made an experiment with the magnetic curves which we obtain by filings. I laid a magnetic bar two feet long upon the floor, and covered it with a glass plate four feet four inches in diameter—thus more than twice as long. On this I strewed iron filings, tapped gently with my finger on all sides of it, and thus procured the well-

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a sensitive of this degree cannot detect magnetic light with certainty beyond forty inches. In the third place, the heavy magnet, a nine-layered, was held in a man's hand, quite close to his body, and thus completely extinguished to the eyes of the observer. This proves a *triple impossibility of seeing any emanations of light from the magnet.* Thus gross errors were committed in the experiments, any one of which would have been alone sufficient to render all sensitive perception impossible. Therefore she actually saw nothing, or only scattered, uncertain, and variable appearances of light—doubtless here and there from a hand, from one or more of the collected heads, from collected heads and hands, from hands lying upon the magnet, and thus rendered stronger; from eyes, from breath, from the pits of the stomachs, or from the knees of the crowd of doctors, &c., where such things accidentally came in contact, and momentarily raised each other's odic intensity. Notwithstanding that I detailed fully, in my writings, how very luminous all these living organs are, scarcely any notice was taken of this by these gentlemen; they moved the magnet about in every possible direction before Reichel, and when she nevertheless perceived light, it never struck any one that there were such things as faces, eyes, hands, pits of stomachs, genitals, &c., all of which are luminous, and this usually more strongly than the magnet. In this confusion of all the conditions of scientific investigations, the poor tormented girl knew no possible way to satisfy the questions that poured upon her; and when incongruous answers were the result of such unskilful experiments, these gentlemen did not hesitate, instead of owning their ignorance, to take refuge under the unscrupulous slander, that the observer was a deceiver. They were not ashamed to decorate this bare assertion with stories which bear the stamp of improbability on their very face. Thus Miss Reichel is said to have slipped slily up to the magnet which one of the doctors held in his hands in the dark, and felt for it with her hand in order to find out where it was. This is clearly false, for it carries its own refutation with it. For if she could not see the odic light, she could not go toward the magnet; and this because it was above the head, under the feet, at the side of, or behind the person who held it, and thus she could not know where to look for it: yet she was sure to catch hold of the body, the head, or the feet of the experimenter, or even to put her hand to his eyes. This accusation is thus evidently nonsensical, and it will be vain to throw dust in the eyes of a thinking reader with such silliness. The girl herself was moved to tears when I told her of this passage in the medical journal, and could not find words to express her pain and indignation at such calumny. The want of accuracy which is here evident cannot be laid to the accused, but to the accusers, and required an earnest correction. People should not set up for judges in a matter when they at the same time exhibit so much ignorance; but to endeavor to cover this ignorance by untruth, at the cost of one who is defenceless, is quite detestable and abominable.—*Author's note.*

known figures. I now led Miss Reichel to it in the dark, without her having seen anything of the arrangement previously. She no longer saw any flame upon the bar, but the magnetic curves were beautifully illuminated. Each particle of the filings appeared luminous to her, and by their arrangement they formed lines of light exactly in the direction of the curves. The whole appearance sparkled at all points at once in every color of the rainbow, and elicited from her the exclamation that she had never seen anything more charming in her life.

452. Two years later I repeated the experiment with the healthy Josephine Zinkel, in the dark chamber. The results were the same descriptions and the same pleased astonishment at the beauty of the sight. She saw millions of brilliant colored stars lighting up the plate, all arranged in the curved lines. She evinced the greatest pleasure when I tapped it gently, and the little stars jumped up and danced about. She saw the whole northern half luminous with a bright bluish light: a brilliant red prevailed more on the southern half. She added the further observation, that the entire glass plate was *bounded* all round its circumference by a *seam of light*, which was composed of all the prismatic colors. According to her statements it was but narrow, some one-eighth or one-tenth of an inch broad, and the colors formed parallel streaks in it. Otherwise, neither the sick nor the healthy observer saw any other figures but the magnetic curves already known. Thus nothing observable had occurred beyond the conversion of each filing into an induced magnet emitting odic flame.

453. The discussion of odic flame may be concluded with a little practical application. There is a fable widely spread in Germany, and our poets have depicted it in the most stirring scenes, that spirits, witches, and devils, collect in great numbers at night, to dance on the Blocksberg. Everything has an origin; and now we see that this myth is not without some kind of foundation. It was discovered long ago, that there are rocky points on the Blocksberg which are strongly magnetic, and divert the magnetic needle: more accurate investigations have shown that these rocks contain fragments of magnetic iron ore,—for instance, the Floenstein, the Snarcher, and others. The necessary deduction from this is, that they emit odic flames, and that these must be visible at night to sensitive eyes. Therefore, when persons of strong odic vision have come to such places on dark nights,—hunters, charcoal burners, poachers, wood-cutters, &c.,—they must have seen delicate flames of various sizes and colors blazing all around, flaring backwards and forwards with currents of air. Who could blame them, if they took this for the devil and all his

train of spirits and hags dancing round? The feast of the Walpurgis Night must now, alas! yield to the sobrieties of physics, which have scattered with their light that fair cloud-picture of fancy.

453. *b.* The compressed retrospect on the odic flame tells us—

a. Very weakly magnetic steel exhibits odic incandescence without flame; as soon as the intensity of the magnetism passes beyond a certain point, emissions of light occur, which display themselves as vaporous, misty, and finally flame-like, especially at the poles of the magnets, and appear not unfrequently as high as a man, even to healthy eyes.

b. Terrestrial magnetism exercises great influence on the size and coloring of the odic flame; and the phenomena of these occur differently according as the magnets are placed with one or other pole towards north, west, south, or east, turned upwards or downwards, in the magnetic dip, or in any other intermediate direction.

c. Iron bars behave like weak magnets in relation to Od, when under the influence of terrestrial magnetism.

d. Banding occurs in the odic flame, just as in the odic incandescence.

e. The direction of the flame exhibits a tendency upwards.

f. Magnet-flames of unlike poles, opposed diametrically to each other, and gradually approximated, exhibit little or no mutual attraction, do not lift each other up, but repulse one another, accumulate around their own poles, and become introverted. On contact, the introverted flames disappear, and a delicate intermingled flame appears enveloping the opposed poles.

g. Odic flames meeting one another cross-ways, carry one another onward.

h. The flame obeys currents of air.

i. All the manifold effects which one magnet produces upon others, are either directly reflected in accompanying odic phenomena, or give rise to peculiar appearances of the odic light. The rubbing of magnets affords numerous examples of this.

k. The same occurs when the armature is used as an induced magnet, and moved in different directions over the magnet.

l. The divergences between Od and magnetism, which arise here, not unfrequently go on to such a contrast that + Od and — M coexist simultaneously in one magnet pole.

m. Electro-magnetism produces the phenomena of odic flame in exactly the same manner.

n. The electrical atmosphere strengthens them, and under certain circumstances reverses the poles.

o. Heat weakens the odic flame.

p. Crystals and animals (human hands) influence the odic flames like magnets, strengthen them, weaken them, reverse or destroy them, both in contact and by mere approximation.

q. The magnetic curves produced with iron filings over bars, present to the eye a multitude of stars of minute odically flaming magnets.

r. Odic flame is a material object, probably a substance rendered luminous, but by no means magnetism.

III.—ODIC THREADS, STREAKS, AND NEBULÆ.

454. It is already known from the accounts of Misses Reichel, Nowotny, and Maix, given in an earlier part of this work, that magnets emit *a light in the form of streaky luminous mist*, in addition to the polar flames of the edges and corners. These observations received confirmation, meanwhile, through repeated perceptions of Baron August von Oberländer, who described the little lateral flames as streaks and brushes; of Miss Atzmannsdorfer, who saw, once between the limbs of a nine-layered, another time of a seven-layered horse-shoe, the whole space filled with threads of flame, and the outer part of the entire magnet enveloped in a delicate fiery mist, both of which she often mentioned in the course of experiments, without my having taken note of it on every occasion; of Miss Zinkel, who found not only the strongest magnets, like seven-layered and nine-layered, but also even a mere single horse-shoe, when rubbed with a five-layered in the dark, covered with a luminous mist two and a half inches broad between the limbs, and two-fifths broad around the outside. She, moreover, saw odic conducting wires, the flames at the ends of wires, also on tinned-plates, disks, and globes of iron, when under induction by a magnet, the first at the edge, the last two over their whole surface, and many other emanations of odic light, appear as streaks, and like a mist; to which I shall recur more circumstantially in their proper places. She perceived these misty luminosities more vividly on open magnets. When closed by the armature, these appearances either vanished altogether, or, as in most cases, merely became dulled and diminished. Farther, through those of Miss Winter, who described a three-layer horse-shoe, as coated all over with delicate fire-mist; of Dr. Nied, who saw a simple horse-shoe, with its armature applied, enveloped to a thickness of one inch and three-quarters with luminous mist, as also a seven-layer; of Miss Sophie Pauer, who, like Josephine Zinkel, saw magnetically induced iron disks and globes enclosed in luminous mist-like vapor; of Miss Wiegand, who perceived a small strong horse-shoe magnet lying upon her hand at night, to be enveloped in fire-mist; of Madame Bauer, who detected fire-mist over all bars and horse-shoes, from the smallest pocket horse-shoe to

the nine-layer; of young Stephen Kollar, old Sebastian Zinkel, and Miss Dorfer, who perceived the lambent fire-mist playing over the sides of all horse-shoes, inside and out; finally, of Madame Kienesberger, who, especially during menstruation, saw all horse-shoes furnished with luminous streaked fire-mist, in such a manner that it was weakest at the curvature, sometimes almost imperceptible, but from here to the poles became continually stronger, exactly as Miss Reichel had described it at first.

455. The emissions of light also exhibited *colors*. Miss Zinkel saw the fire-mist between the limbs of the horse-shoe, red on one side, and blue on the other, the colors playing into each other, so that the interspace had a variegated appearance. This was still stronger with compound horse-shoes, because each limb gave out red and blue mist at once, extending inside and outside as far as the curvature.

456. This luminous mist was very vividly developed along the magnetic bars, which *I exposed to the influence of the electrical atmosphere*. The observer found single bars enclosed all along in fire-mist nearly two inches broad. The interspaces between the limbs of horse-shoes then became completely filled with it, and gave the appearance of masses of luminous threads, variegated with red and blue sometimes even in the prismatic colors.

457. The emissions are always stronger from the *corners and edges* of magnets than from their surfaces. In bar magnets they are symmetrical on the two opposite sides; almost absent in the axis of the bar, then increasing gradually toward the poles, strongest at the ends of the poles, not at the magnetic foçi, which, as is well known, lie about one-seventh of the half-length of the bar below the poles. But on horse-shoe magnets it is unsymmetrical, and was seen by Madame Bauer, Madame Kienesberger, Miss Atzmannsdorfer, and Zinkel, far more vividly inside the limb than outside; so that the streaked emissions from the limbs in many cases occupied the greatest part of the space between the limbs, and in some filled up the whole with their luminous fiery mist. Mr. Pauer could only detect the fire-mist clearly between the limbs of the magnet.

458. When I *applied the armature* to open horse-shoes which possessed the fire-mist, this instantly diminished considerably, but did not disappear. According to the observations of Miss Atzmannsdorfer and Miss Zinkel, it became rather more than one-half narrower and shorter, but more especially duller, less luminous, and more opaque; if it had been yellow and red previously, the influence of the armature would make it greyish-yellow, or wholly colorless and grey. This was also the case when I closed the horse-shoe magnet with a second horse-shoe instead of the armature. Dr. Nied, who

observed very strong odic mist upon open single magnets, could scarcely see anything of it, detecting only the dull odic incandescence of the steel, as soon as I applied the armature. His sensitiveness is weaker. The conduction through the armature was thus apparently imperfect in all cases, and a portion of the current of the dynamic constituting the magnet, continually passed off into the air. These confirmations are more than sufficient to warrant the accuracy of the original statements on this head given by Miss Reichel, as set down in the first part of this work.

459. It is very probable that these envelopes of fire-mist are constant, spread over the whole of the magnet, weak but interruptedly continuous emanations of Od, only perceptible to the higher sensitive, on account of their slight degree of intensity, and scarcely, or not at all, to those of weaker sensitive vision.

460. Almost all the highly sensitive also described to me *isolated colored threads which they perceived in the odic flame.* I have already mentioned this of Miss Atzmannsdorfer and others. Madame Bauer also called my attention to this observation. The Baroness von Augustin saw them rise frequently over the nine-layer, and a five-layer; also from an electro-magnet. I examined this phenomenon most accurately with the healthy girl Zinkel. On nine-layer horse-shoes she saw many separate, strongly luminous, thread-like streaks, rise out from the poles into the odic flame, which were not very slender, but about as thick as a common pin, not taking their origin below immediately from the steel, but first distinctly formed at some height above it in the odic flame. These threads she always found either blue or red. They did not move, but always flowed forth uniformly in the flame, especially in its upper parts. She observed this phenomenon most clearly in the banded alternation of the colors of the odic flame over the layers of the nine-fold horse-shoe, mentioned at § 396. Here she distinguished accurately, that, from the red odically incandescent layers, arose red, and only red streaks of light, from the blue odically incandescent layers blue and only blue in the flames, which were always of just the same color.

461. I do not think these phenomena are of special kind, but look upon them as equivalent to the rest of the odic flames in general. The cause probably is inequality of the issue from the surface of the magnet at very minute points. Since we know that edges and corners cause stronger emission, I think we have a right to assume that smaller unevenesses may serve as points of emission, and thus cause the formation of threads, streaks, and mist-like appearances.

They are little currents of Od locally concentrated in the general current, blue from the negative, and red from the positive poles.

IV. ODIC SMOKE.

462. The next phenomenon of light attaching itself to the odic flame of the magnet is a peculiar luminous vapor or smoke, which ascends from the magnet, and is seen by the sensitive in the dark. I made little or no mention of it in my earlier treatises; but as in the further prosecution of my researches it pressed itself upon me unavoidably, and always in the same manner under like circumstances, I have necessarily recognised it as an essential part of the odic luminous phenomena, and turned attention to it.

We will, in the first place, hear and critically compare the statements of the many witnesses I have met with.

463. First, the healthy sensitives:—

Mr. Edward Hütter saw a dim, cloudy appearance over a pocket horse-shoe, which, as he moved the magnet in the dark, was carried about with it, and thus doubtless belonged to it. The Baroness Pauline von Natorp saw five and seven-layer horse-shoe magnets covered with a luminous cloud at the northward pole alone. She perceived slight marks of a misty brightness on the nine-layer. She discerned a grey smoke ascending to the height of one's hand from an electro-magnet. Professor Ragsky saw the northward pole of a single horse-shoe magnet emit, with intermissions, a bluish, weak, and vaporous light. Professor Huss, of Stockholm, the Court Physician, perceived abundance of smoke rising, and passing up in clouds, from a strong electro-magnet. Mr. Demeter Tirka observed that the same nine-layer was enveloped in a cloudy luminosity, which weakly lighted up its entire circumference. Mr. Pauer saw all largish horse-shoes exhale vapor. He perceived a luminous cloud over each pole of a strong electro-magnet. Mr. Hochstetter discerned a grey smoke ascending forty inches high over the nine-layer magnet: when I placed the horse-shoe in the electrical atmosphere of the conductor, he saw smoke rise to the height of a man over the odic flame, throwing a light upon the ceiling. Mr. Sebastian Zinkel observed smoke produced over the odic flame of a single horse-shoe to three times its height. Mr. Fernolendt saw luminous opaque smoke ascend to the ceiling over several horse-shoes in the electrical atmosphere of the positive conductor. Madame Josephine Fenzl, at various times, perceived a cloudy light, like thin smoke, almost as high as a man, over the flame of a nine-layer horse-shoe. Madame Isabella von Tessedik and the young Stephen Kollar found all bars, horse-shoes, and electro-magnets, to possess misty lights, either only at the northward or at both poles; the latter saw the smoke whirling up in clouds. Mr. Theodore Kotschy saw a wide-spreading light sweeping like a vapor over the nine-layer, resembling a delicate halo, more than forty inches high; the same was detected by Madame von Varady and Madame von Peichich. The joiner, Klaiber, observed a luminous smoke above the flame of a three-layer horse-shoe, gradually losing itself in the air above. Mr. Gustav. Anschütz saw a lambent vaporous light appear on a three-layer going and coming, always at the northward pole alone, sometimes paler, sometimes brighter. Another time he saw unipolar misty lights appear over several horse-shoes, but remaining constant. On the nine-layer, in imperfect darkness, at his own house, he saw a misty ball of light wave over one pole alone. Mr. Delhez perceived a column of smoke above the efflux of light from a large electro-magnet ascending vertically to the ceiling of the dark room, and then producing a large, illuminated patch, larger than the nine-layer caused. The smoke was diverted there, and flowed visibly along the ceiling. Miss Ernestine Anschütz perceived the odic vapor over the nine-layer, and over a five-layer, most distinctly when I approximated the friendly poles of the two little magnetic bars to them. Mr. Nicolaus Rabe saw every odic flame that issued from magnetic poles pass gradually into a light vapor; he estimated this at four to five feet high over the nine-layer magnet. He saw a large bar magnet, four feet long, with flame twenty inches long at the northward pole, and twelve inches long at the southward; both flames then passing into smoke, which was light and fine at the northward pole, and dense and duller at the southward. Miss Sophie Pauer perceived a flame twelve to sixteen inches high over the nine-layer, and this passing above into luminous smoke, which ascended almost to the ceiling. But in the electrical atmosphere she saw its smoke strike against the ceiling. Baron von Oberländer detected many of the emissions of odic light as delicate vapor, especially the large column of odic flame of a heavy nine-layer horse-shoe, appeared to him to pass above, when it approached the ceiling, into a kind of thin smoke. Professor Endlicher discerned, over the luminous emissions, forty inches long, of a strong electro-magnet, a column of smoke-like, weakly luminous vapor, which rose vertically to the ceiling of the dark chamber, was turned aside then, and flowed onwards horizontally, lighting it up. Wilhelmine Glaser saw the nine-layer alone, but still more when within the electrical atmosphere, as well as large bars pour out smoke above the odic flame, up to the ceiling; also the electro-magnet. These last observations were repeated on a greater scale with Madame Cecilia Bauer; she saw smoke above the odic flame on all magnets without exception,—on the stronger partially brilliantly colored, as if iridescent and containing sparks. She always saw it stronger, thicker, and duller over the reddish odic flame; finer, thinner, and lighter, on the blue. Dr. Nied observed vaporous exalations over every flame-like emission, both from magnetic bars and horse-shoes. He always found them stronger on the southward pole than on the northward, especially on a single and a seven-layered horse-shoe,—of an arm's length in the latter. He saw a column of vapor ascending from a nine-layer horse-shoe rising to the ceiling, and luminous. The Baroness von Augustin discerned smoke in rolling clouds rising vertically to the ceiling, over the flame-like lights on the nine-layer, and still more over an electro-magnet. Josephine Zinkel, in a series of experiments—to enumerate which would be a wearisome repetition—saw every bar-magnet and every horse-shoe of tolerable strength, change, at the positive pole, from reddish flame into dense, dull, weakly luminous, reddish-yellow smoke; at the negative, from blue flame into delicate, ethereal, greyish-blue vapor. On the smaller or simpler horse-shoes she found these clouds like emanations from four to twelve inches long,—on nine-layered often as long as one's arm, and, when it was strengthened, eighty inches and more in length. She saw magnets of high intensity, especially at her periods of menstruation, covered all over with delicate vapor close to the poles: she saw the smoke emerge to an arm's length from the banded flames of horse-shoes composed of several layers; during the rubbing, and in the different relative positions the two horse-shoes were thereby made to assume, she saw a rubbed single horse-shoe throw out dense clouds of smoke, especially at the southward pole: in many cases she saw only blue flames at the northward pole, and no flame at the southward, but only dull reddish smoke. When, under such circumstances, the curvature of a single horse-shoe lay upon the poles of a five-layered, whereby—as we have already seen—the flames on the poles of the former were doubled, there was also always a simultaneous marked heightening of the odic smoke at the positive, and of the odic vapor at the negative pole, over the flames of the rubbed magnet. But when this was so attached to the rubber at two-thirds of its length, that it would no longer support the armature, and its poles thus came into a condition of magnetic indifference, there was a little blue flame visible at the negative pole, but at the positive none whatever; only reddish smoke. A horse-shoe electro-magnet exhibited masses of smoke whirling up violently above both polar flames, and the beholder could here distinguish isolated flocks of smoke continually detaching themselves from each other, like drifting clouds, which was also frequently described to me by the joiner Klaiber, and others. She saw the nine-layer emit dense smoke from the flames when in the atmosphere of the electrically charged conductor (§ 436): this was the case also when the proximity of the conductor had caused a reversal of the polarity in bars and horse-shoes: these masses of smoke rose up to the ceiling, and sometimes illuminated the painting upon it, so that she was able to distinguish the lines of the pictures here and there. She always saw the smoke rise in greater abundance from the positive pole than from the negative, especially on electro-magnets. Small bars or needles four inches long sometimes appeared without flames at either pole, but the negative pole with grey smoke. She saw bars of twenty-four and forty-eight inches in length, furnished with smoke over the flames of both poles, weaker and bluish-grey at the northward pole, stronger and yellowish-red at the southward. When I placed caps of different forms upon bar magnets, so that the poles terminated in two, three, or four teeth, each tooth delivered its own weaker current of smoke over its flame. When I approximated the friendly poles of two bars eight inches long to the beholder, she observed in the smoke, as in the flame, the tendency to flow out toward each other, and meet; but when they came near, the union, which seemed imminent, did not come to pass; for the flowing vapors, retracted together with their flames around their own poles, and accumulated upon them, were introverted with the flames, as I have already described of certain odic flames. When I approximated two horse-shoes together in a similar manner, the result was similar; when they lay upon a table (see above, §§ 394, 405), the ascending smoke was first formed in the middle between the two poles at the ends of their flames. When the poles came so close that the flames were introverted around their own poles, the smoke was no longer produced in front of the poles, but behind, toward the curvature, from the introverted flames; and when the approximation of the flames together was great enough, from out behind the curvature in the manner already explained above; to which I refer. The behavior of the smoke is parallel in all cases, in size and intensity of light, to that of the odic flame.

464. Now the sickly and diseased sensitives:—

Miss Dorfer saw the flames pass off into smoke on various magnets. Miss Winter discerned in the dark, emissions of odic vapor, from a three and a five-fold magnet, not merely from the poles, but the entire horse-shoes enveloped in it. Miss Weigland saw the nebulous flame of a little pocket horse-shoe wholly enveloped in luminous vapor. Miss von Weigelsberg saw the same horse-shoe emit unsteady clouds, an inch to an inch and a half long at the poles, longer at the one than the other; they appeared to increase and diminish somewhat, alternately; at another time, she found all magnets that were presented to her throw out clouds, especially at the poles. Madame Johanna Anschütz observed luminous vapor rise to the height of a hand from the poles of a five-layer, a foot high from those of a nine-layer horse-shoe; in like manner luminous clouds waving upon the poles and between the limbs of a large single horse-shoe. Madame Kienesberger saw on all many-layered horse-shoe magnets the polar flames pass into odic vapor above, which became gradually lost further up. She detected this with especial distinctness over the poles of the nine-layer, where she saw the misty smoke rise to almost the height of a man. Madame Kienesberger also thought she could distinguish between the lower and upper parts of this emanation of light, and believed the former to be more ethereal and misty, the latter more like smoke, becoming more attenuated, and vanishing some distance higher up. She undoubtedly saw the luminous mist below of the negative pole, which all the observers perceived to be shorter, better than the smoke of the positive pole, which reached up beyond the former, and ascended towards the ceiling. Her statements about the odic mist and smoke over a large electro-magnet agreed so completely with those of Zinkel, that there is no necessity to repeat them: she also saw the odic mist rise to the ceiling; but this only happened in such a degree when a rather strong Smee's battery was employed: with a smaller battery the smoke and flame did not rise so high, the flame not above eight to twelve inches. Terrestrial magnetism also sufficed to produce similar effects: a soft steel rod, fastened by the middle in a wooden holder, and placed in the meridian, appeared to her to have little flames and short smokes at both poles, grey at the northward and yellowish at the southward pole. When I brought this rod into the direction of the dip, the remarkable phenomenon again appeared of antagonism of magnetic and odic polarity, and reddish-grey flame was displayed at the lower negative magnetic end, bluish at the upper positive, with odic mist of the corresponding colors at the two sides; in this instance the reddish-grey smoke, being shut out downwards, struck against the floor, at the distance of two feet, and then spread itself out on all sides. Friedrich Weidlich could not at first see various magnets I placed before him; but after he had remained more than an hour in the dark he distinctly perceived the nebulosity next the odic flames which were lost in it above: he described the flame and smoke as passing into one another in such a manner that in particular places they were indistinguishable. He saw a five-layer smoke particularly strongly; it was of newly and pretty strongly magnetized steel. He saw dense reddish clouds of smoke rising in confused masses from the flame, as high as a man; from the nine-layer magnet, ascending to the ceiling, and whirling upwards in constant streaming motion. When I blew it, he saw it driven about and disturbed for a few moments, but soon returning spontaneously into its former position. On another opportunity I made a new series of experiments on the nine-layer magnet with him; he again saw the smoke rising up to the ceiling, as it were in clouds following one another. Johanna Kynast also perceived that the flame, of a man's height, of the nine-layer, possessed luminous odic smoke. Miss Marie Atzmannsdorfer saw the odic smoke over magnets so very many times that I ceased to set down any further notes of it, and shall merely observe, that when her visual power was weakened by any circumstance, or she had not remained long enough in the dark, she always detected the odic smoke before she could see the odic flame; and that as her vision increased and became more acute, the mists appeared to yield to the flames and took their place upon the latter; yet if the odic flame by degrees became developed with greater intensity of light, the smoke appeared to become paler than before. She often saw strong odic smoke, from the nine-layer, spread out upon the ceiling, and illuminate the whole of it for several minutes.*

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* Thus we have here a dozen new testimonies added to the numerous proofs of the accuracy of all Miss Reichel's statements! It would be quite inconceivable how the Vienna physicians could possibly arrive at the monstrous declaration, that Miss Reichel had never seen any magnetic light whatever, and therefore was an impostor, were it not that the reader of their report sees at a half-glance how their experiments swarm with errors and mistakes. One among these, and not the least, was the collection of ten to fifteen young men in the space of a small room. Whoever has the least knowledge of this subject knows that human beings exert a very strong reciprocal odic influence upon each other; and it is explained at length in my treatises, that a human body is a constant source of magnetic, or, more properly speaking, odic force, radiating in all directions. With such reciprocal and universal active influence in action, how could a dozen doctors and professors expect and ask that an ignorant sensitive placed in the midst of them should have any clear ideas of the complicated forces acting in every direction, and give clear and scientifically available answers to the questions which they themselves did not understand how to put correctly? Every human being is a much stronger source of Od than a steel magnet. The immediate vicinity of a single man, in many cases, on the one hand, destroys the vision of a sensitive; and, on the other, interferes with the visibility of a magnet. When I make an experiment on light with a sensitive, in the dark, the first thing I do, before putting my questions, is to draw back several paces, first from the person, then from the object of the inquiry, to remove the influence of odic radiations from my own body, which would complicate the results, and render them unavailable for the purposes of science. Instead of observing similiar precautions, these gentlemen stationed a doctor on each side of Reichel, who sometimes held her hands,—a

471. That which more than twenty witnesses have here deposed is essentially consistent, not only in itself, but also harmonizes with what we already know concerning the odic flame, with which it is most intimately connected; it therefore bears the stamp of truth so surely that it can only be denied in random, inconsistent talk, which, however, unfortunately is met with in many persons who wish to be called philosophers, but who very often do not possess even a smattering of scientific logic. If we now compare the above scattered perceptions of so large and so varied a series of observers, during a space of more than three years, we come to the following axioms:—

a. All magnets, steel permanent magnets as well as soft steel and iron induced magnets induced by terrestrial magnetism and electro-magnets, exhale in the dark a misty and *smoke-like delicate vapor*, next to the odic flame; it also flows from the sides of magnets, although much more weakly, and often imperceptibly. The strength of its efflux diminishes from the poles to the magnetic axes; in the axes it is relatively very small, but not absolutely wanting.

b. The magnitude of this smoke-like luminous essence is directly proportioned to the size of the odic flames associated with it. When this amounts to an inch or so, the longitudinal extent of the smoke does not much exceed these dimensions; when the odic flame rises to a yard or more, the odic smoke ascends to the height of a man,

condition which no sensitive whatever can endure,—and then placed the magnet opposite her, on some one's knees, &c. It is impossible to help laughing at the idea of such experiments. Reichel, thus put to the torture, was now, on the one side, to corroborate the ignorant declarations of prejudiced persons who placed her in this unsuitable position, and who were exposed to shame by every negative answer she gave; she was further to answer the strained expectations of the assemblage, who unceasingly irritated her by mockery, and drove her to outbreaks of anger by contemptuous treatment; in this total disturbance she was to solve with precision the most delicate possible problems that can be offered to touch or sight,—solve them under physical and moral conditions in which they were absolutely insoluble, ... what else could result, but the miserable confusion with which the pretended report of the butted girl's answers abounds? Under such circumstances it is not worth the pains to go into the separate statements, whether repeated truly or untruly, understood or not; the whole is mingled together in a hopeless complication of mistakes.

Reichel was, in her time, a most excellent sensitive, the best that could be desired for scientific investigation, had extremely delicate sensation and excitable vision, at the same time was willing, persevering, accurate and truthful in her statements, modest in expressing her opinions, and acute in comprehending properly stated questions. But one must not ride rough-shod over such tender instruments of delicate investigation. Neither did these gentlemen know what they wanted, nor did the girl or her helpless guides what to do. Science is not created in this way, but people may thus expose their foolishness, and insolently cloak it by calumny, at the cost of an unprotected woman.—*Author's Note.*

and higher. But its magnitude is also proportionate in the same way to the size as well as to the intensity of the magnet from which it issues. Large magnets of small intensity (like my nine-fold horseshoe in many cases) gave large odic smoke; small magnets of greater intensity afforded proportionately long flames, with abundance of vapor. But no pretensions are made at present, in the very beginning of the discoveries, to accurate determinations of dimensions.

c. The odic smoke is *thrown out by magnets* with a certain *force*, which gives it the first direction, but after that it exhibits a constant *tendency to ascend, to flow upwards.* When it reaches the roof of a room it spreads out, flowing away over it, illuminates the painting on it, and displays a certain, though short, permanenee. Whatever material substratum may form the basis of its manifestations, it is in any case either lighter than atmospheric air, or it suffers some kind of repulsion from the earth's surface, driving it away; that is, upwards.

d. It exhibits certain differences, according as it issues from the positive or from the negative poles of the magnets; the positive, southward pole, gives it out reddish-grey and yellowish-red grey, thicker, inclined to produce cloudy masses; the negative, northward pole, affords it blue-grey and bluish-grey, more delicate, lighter, and more ethereal. When its intensity diminishes, more of green (grey ?) becomes intermingled in both kinds of odic smoke; at last they become wholly grey. Yet there occur exceptional cases, when the odic smoke of the magnet-poles changes, blue smoke appearing at the positive pole, and red at the negative; this happens when bars are placed in the direction of the dip, and in a few other cases of special nature,—*e. g.*, where there is reversal of the odic pole while the magnetic polarity remains unaltered, &c.

e. Although always present above the odic flame, yet there are also cases when it is visible without it. This occurs when the magnets possess no great intensity. In such cases the sensitive frequently see a blue, uni-polar flame appear over the northward pole, with no flame on the southward; but instead of this, a thick reddish odic smoke from it. In still weaker examples no flame at all is seen at one pole alone; and, nevertheless, odic smoke is detected over either one or both.

f. The odic smoke so far displays a material nature, that it may be disturbed and broken up by blowing on it, on which it requires a short space of time to recover the original shape in the succeeding waves. It has, to a certain extent, the aspect of the vapor of phosphorus, only with much weaker luminosity.

472. The relation between odic flame and odic smoke is a question we now approach; but it is one very difficult to answer at present.

Whether they are really two specifically different, or only one in different modifications, I cannot now decide. All the inquiries I have made on this subject, of those who have had both before their eyes, have been answered by the assurance that the two are quite as different as a common flame, and a luminous smoke issuing from it and losing itself in the air above. Nevertheless, when I reflect that sensitives of weak vision in all cases see only smoke where the more highly sensitive perceive flame with smoke wavering over it; that when the former discern small flames with little smoke, the latter describe much larger flames with much stronger smoke; that the same persons also see the same things diminished when their vision is weaker, which appeared large before; that, moreover, while a blue flame with grey smoke is observed upon a negative pole, on the positive no flame at all, but only reddish grey smoke; that there are magnets which emit only smoke, without flame, from both poles; finally, that sensitives, whom I have kept for a long time—say half a day—in the dark, at first thought all the magnets possessed only smoke, but after an hour's sojourn perceived flame and smoke on all, and, after several hours, found large columns of flame and vast masses of smoke developed gradually on particular magnets:—by all this I am compelled to conjecture that flame and smoke may perhaps be only one and the same thing,—differing, on the one hand, only in the degree of intensity; and, on the other, detected with different degrees of clearness according to the measure of the visual power of the beholders, or of one and the same beholder according as his or her sense for the perception of odic light is more or less perfectly unfolded, through more exalted sensitive disposition, or more perfect predisposition of the eye resulting from long sojourn in absolute darkness. In this case the first degree of perception would be a faint luminous cloud; a second or more distinct, thicker or brighter mist,—at first grey, then yellowish red-grey on the positive side, and blue-grey on the negative,—then reddish on the former, bluish on the latter. A third or fourth degree, the appearance of flame accompanied by vapor,—first the blue, next the red. Lastly, upon these, especially the latter, the dense rolling upward of clouds of smoke, whirling up to the roof of the laboratory. I say "I seem compelled to conjecture," for I wish to keep every one of my theoretical views in all cases perfectly distinct from the facts of experience, which I here set down from the concordant statements of many sensitives, and which, in any case, are more certain than even the simplest of my speculations. So long as we are ignorant of what these odic luminous phenomena, taken as a whole, are,—and I do not think it looks likely that we shall very soon penetrate into the depths of its essence and origin, in the face of the prejudiced opposition of many physicists,—so long will the whole nature of these beautiful phenomena remain a mystery, so long shall we find it difficult to arrive at a firm judgment as to the identity or intimate difference of their manifold kinds; and therefore for the present we must, in our study and nomenclature, keep to the forms of their sensuously perceptible occurrence.

V.—Odic Sparks.

473. A fifth has now to be added to the four forms of the luminous phenomena already described, of small compass, but of vivid strength. This consists of the *sparks* which make their appearance in the smoke, and are separately whirled about in it. Miss Reichel first described them, and she saw them frequently, not merely in magnetic smoke, of which alone we shall speak first here, but under many other circumstances, in relating which I shall subsequently recur severally to these. The first characters of these are very faintly indicated in fig. 1 of the first Treatise, most distinctly at the sides. They were seen very distinctly in this form by Baron von Oberländer, who compared them with the flying sparks of glowing pine-charcoal. Several other observers, in particular Miss Atzmansdorfer and Johann Klaiber, frequently compared them with fire-flies. Miss Girtler called them wee little stars. Miss Winter saw them fly about in abundance, especially rushing upwards with an angular motion near the wall of the room. She had previously seen them very frequently at home during severe nervous attacks. Mr. Delhez saw them darting about separately in the smoke of the electro-magnet, scattered without order. They were seen in abundance over a globular electro-magnet (§ 587) by Professor Huss. Baroness von Augustin saw them rise from the nine-layer, but in still greater numbers from an electro-magnet. Miss Nowotny observed them issue in greatest number from magnets; and Madame Kienesberger remarked them not only in the smoke of the nine-layer, rising singly, and scattered almost to the ceiling, but also issuing from the electro-magnet. Friedrich Weidlich and Miss Sturmann observed them in the smoke of large and small magnets. Dr. Neid and Mr. Rabe saw them stream forth in the misty emanations of the nine-layer, many being extinguished in their passage, but some rising to the ceiling. Miss von Weigelsberg, Mr. Gustav. Anschütz, and his sister Miss Ernestine, compared them to fire-flies flying up in the odic vapor, and then wandering here and there. Madame Bauer saw them rise to the ceiling in the smoke of the nine-fold magnet. Professor Endlicher saw them rise singly with the smoke of a strong electro-magnet, ascending to the ceiling;

they wandered about separately in the odic smoke, and in part flew out from it, and consisted of larger and smaller, more and less brilliant points. Wilhelmine Glaser observed such abundance of them in the electrical atmosphere, that they rushed up almost in a stream. She also saw them appear in great quantity in the smoke of a large electro-magnet. Josephine Zinkel described them as extremely small luminous points, which moved irregularly upwards, separately, in variable but always small number, with the odic smoke, sometimes also sinking down, and then rising up again in it. Many times they disappeared wholly for the space of a minute; then three, four, another time eight to twelve, appeared again at once in different places, and sometimes several grouped together. It even happened that a single one fell upon the table, upon an arm, or into the bed, and there remained a few moments before it was extinguished. On a bar magnet which had had its negative pole exposed to the electrical atmosphere of the positive conductor, she saw them much increased not only at this but at the opposite positive pole. All these persons expressed lively pleasure at the sight; just such as one hears when a party are returning home through a wood at night, and, meeting with fire-flies, their attention is suddenly diverted from everything else, and fixed wholly upon these.

474. I used the nine-layered horse-shoe in an experiment especially directed to this point with the healthy Josephine Zinkel. I turned the poles upwards and placed them in different positions,—sometimes in the meridian, sometimes in the parallel. Under all circumstances, she saw the sparks rise, mostly separate, sometimes two or three together, of very remarkably intense luminosity, but in all cases small. She distinguished the two colors here, red and blue. The red flowed in greatest number from the southward pole, the blue from the northward. But blue sometimes came from the former, and also red sometimes from the latter. The reason of this apparent anomaly, which at first was an enigma to me, is very well explained above, (§ 396.) The blue sparks issued from the negative layers, the red from the interposed, which had become positive by reversal; the opposite condition occurring at the other pole. They appeared abundantly when the nine-layer was exposed to the influence of the electrical atmosphere, and all the emanations of odic light were thereby increased; the sparks then presented themselves in greater abundance, and this the greater in proportion as I approached the magnet nearer to the conductor. (Vide § 436.)

475. Miss Zinkel represented this phenomenon as most beautifully developed, when I formed a large electro-magnet with a strong Smee's apparatus. Not only did a quantity of separate sparks spirt

out on all sides from the large, brilliant odic flame, but they collected into a regular stream, and rose upwards with the smoke to the ceiling. She found the brightness of this so vivid that she could not conceal her astonishment that I saw nothing of it.

476. Finally, something similar was seen when I rapidly pulled off the armature of a horse-shoe, and this the more strongly the more powerful its magnetism was. At the moment of separation, Madame Bauer, Josephine Zinkel, Leopoldine Reichel, Dorfer, and others, saw abundance of sparks flash up like lightning and disappear again instantly; immediately after this the odic flame began to appear and unfold itself.

477. The reality of this phenomenon, established concordantly and uniformly through so many healthy and diseased sensitives, and confirmed by innumerable experiments, does not admit of doubt. I do not venture now upon a speculation as to its nature, or even its connection with the other simultaneous magnetic odic luminous phenomena. At present, I can only establish the physical fact, as represented in actuality to the sense of vision of the sensitive.

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478. Now that we have made some acquaintance with the *different* kinds of development of light from magnets, we will turn to the *differences of circumstances* in which the magnet may be placed during this development of light, and inquire into the influence they may be able to exert over the same.

ODIC LIGHT IN MODIFIED EXTERNAL CONDITIONS OF THE MAGNET.

In altered media.

479. We know how very differently the phenomena of electrical light present themselves in a vacuum, even under less than the usual pressure of the atmosphere. Since I was ignorant of the share atmospheric air might take, in a similar manner, on the luminous emanations of magnets, I frequently placed magnets under the air-pump in the presence of sensitives in the dark. I employed for this purpose large and small single horse-shoes, which I placed with the poles turned upwards under the bell, in a large glass goblet, so that everything would be seen well on all sides, and small bars which would lie down horizontally under the receiver.

480. The question was solved even by the blind joiner Tischler. When all was prepared, but before I had begun to exhaust, I led him up to the bell. To be certain that his attention was directed to

the right place, I guided his hand to the bell; but he could not perceive anything, the magnet emitted too little light for him to be affected by it through the glass. I then began to exhaust. Very soon, when the air was about half extracted, he became aware of the light. And as the rarefaction increased the light grew, and attained its greatest strength and extent for his shattered visual powers when the rarefaction was brought to a one or one and a-half inch column of mercury. My air-pump was incapable of giving beyond this. When, as a converse test, I let the air suddenly back into the bell without telling him, he expressed himself unpleasantly surprised by the extinction of all light, and the sudden return of darkness. Miss Amalie Krüger detected a little flame only on one pole, the northward, after a certain amount of rarefaction of the air; the brightness evidently increased as the rarefaction went on, but only so long as the piston was in action; as soon as it went back, the light became paler, and she soon lost sight of the luminosity. Mr. Demeter Tirka, perfectly healthy, as also Johann Klaiber and Madame Kienesberger, in like manner did not see the magnet at first, but when the air was half pumped out the magnet appeared odically incandescent: on further exhaustion, Klaiber observed the flames over the poles, at first dull, then becoming brighter with each stroke of the piston, so that at last very vivid flame flowed about under the bell. As soon as I let in the air again, every trace of light vanished from all three observers, but returned when the pump had been in motion a short time again. Mr. Hochstetter also saw nothing of the magnet at first, under the bell; but when a portion of the air was pumped out, the magnetic bar, the bell, and all its contents, became luminous, disappearing again on the re-entrance of the air. Baroness von Augustin did not see the bar magnet under the exhausted receiver; but as soon as I had rarefied the air perceptibly, she discerned it, and as the rarefaction increased, the light under the bell also gained strength, till at last this appeared wholly filled with a luminous appearance, with the magnet forming the centre. Miss Dorfer saw little flames arise on the poles after a few strokes of the piston, moving and varying with every rise of the piston. When the rarefaction was carried very far, she saw the polar flame strike against the vault of the receiver, curl round there, and flow downwards again on the glass: she compared the appearance with water flowing in a curve out of an inclined pitcher. The whole contents of the bell became dark again on the opening of the air-cock. Madame Johanna Anschütz, and Mr. Gustav. Anschütz, his sister Ernestine Anschütz, and Miss von Weigelsberg, whose degrees of sensitiveness differ but little, saw the magnet, with slight modifications of perfection and intensity of the phenomena, become more brightly incandescent with each rise of the piston; flames were developed at the poles, stronger at the northward, the latter striking against the vault of the receiver, there curving and turning downwards, and all vanishing again the moment I opened the air-cock; on the other hand, reappearing, step by step, as the air was, stroke by stroke, pumped out again. Baron von Oberländer described the phenomena in exactly the same way. Friedrich Weidlich's statements agreed accurately with the above in various repetitions of the experiments at distant intervals. Miss Sophie Pauer, Madame Cecilie Bauer, and Wilhelmine Glaser, at first did not see a bar magnet at all under the receiver; but it became visible, odically incandescent, by the time the rarefaction had been carried to about one-half. On further exhaustion, they successively perceived both odic flames, then odic smoke, completely filling the receiver, the bell itself, and the glass knob at its summit, at last becoming odically incandescent. The last beholders saw the odic flame of the northward pole blue, that of the southward yellowish red, as in the open air, and flowing obliquely upwards from both poles, on the walls of the glass. As soon as I opened the cork which let in the air, all visible light vanished; and all this in repeated experiments at various times. Josephine Zinkel added to the previous observations, that, when the experiment was continued for some time, the entire empty space became filled with odic mist, and that finally the bell itself became luminous; even the glass knob which it had on the top, acquired white odic incandescence, persisting in this knob for some time after the air had been re-admitted into the bell. As an exceptional case, I first showed the experiment to Miss Atzmannsdorfer, while she was in the somnambulistic condition, on which, otherwise, I do not readily incline to make odic experiments. She gave the order of succession of the phenomena in exact agreement with all the other sensitives: after a few strokes of the pump increasing odic incandescence, odic flame rising until it struck against, and was diverted by, the vault of the receiver, luminosity of the glass, and sudden extinction on the opening of the air-cock. She added, that the odically incandescent steel was transparent, almost like glass,—a statement which we have already met with before. Two months later, while she was in the waking condition, in which she knew nothing of the previous experiments, I repeated them with her several times. I always obtained the same enumeration of the phenomena of light; she also, like Josephine Zinkel, saw the bell, and even its knob, become incandescent. She observed delicate flames between the arms of the horse-shoe, occupying the entire interspace; the fiery mist on the outside filled the whole space as far as the side of the receiver. The flames were more bluish from the northward pole, more reddish from the southward, but with prismatic colors intermingled. She gave the more minute particulars as to the odic smoke, that at the commencement of the exhaustion it increased in light and fulness, not, however, continuously, but only up to a certain degree of rarefaction; that it then became duller again, decreased, and when the air was very highly rarefied it almost vanished, while the flame was most beautifully luminous, and flowed brilliantly down the sides of the receiver. The odic smoke was in continual revolution inside the bell as long as it existed. The bell itself, though it became odically luminous throughout, even in its knob, produced no odic smoke externally. These last statements, of which, however, I have not any corroboration from other observers, and, therefore, shall for the present keep back the conclusions to be drawn from them, are evidently of great interest in reference to the judgment of the distinction between odic flame and odic smoke.

481. These observations, collected into a regular form, show:—*The phenomena of odic light of the magnet are modified under varied atmospheric pressure. They increase considerably with rarefaction of the air.* Magnets which, in the open air or under an exhausted receiver, cannot be seen to emit light in the dark, acquire brilliant odic incandescence, and very distinctly visible odic flames on their poles and between their arms, by the time the air is only about half exhausted, and the emanations of light, bluish at the northward pole, reddish at the southward, and intermingled with prismatic colors, continue to increase as long as the rarefaction of the air is carried forward. Then the receiver becomes so charged with Od, that it is rendered luminous, odically incandescent, even to the glass knob at its summit. The odic flame does not penetrate through the glass, but strikes, as it were, against it, and curls round upon it as a common flame would, and as Miss Reichel had previously described, under other circumstances, when the odic flame curved round on the cover of a Schweigger's multiplier, (§ 434,) and when a glass lens was brought down upon it, (§ 20,) like the fire does when a pan is placed over it. Odic smoke is also formed, and increases, but only up to a certain point of the rarefaction, beyond which it decreases again, and probably wholly disappears on complete exhaustion. The odically incandescent glass bell is not capable of producing odic smoke on the outside.

482. It follows from this that the pressure of the air obstructs the development of odic incandescence and odic flame, and that these are unfolded more strongly and in greater extent when the pressure is

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o a certain exlessened or removed. In this respect they both exhibit a certain degree of resemblance to electricity,—but only resemblance, not identity. The development of odic smoke seems only to benefit up to a certain degree by the rarefaction of the air; in the absence of air it appears no longer to exist, and consequently seems to be connected with the presence of air. The sensitives did not indicate any appearance of odic sparks under the air-pump. The glass of the receiver appeared to act as an impediment to the odic lights,—namely, the flame and smoke, which it restrained and repulsed, while the Od itself penetrated it, took possession of it, and rendered it independently odically incandescent.

483. I chose *water* as a medium lying on the opposite side of air, and affording *greater intensity*. A little horse-shoe, which had been freshly magnetized, and from which the polar flames flowed vividly in the dark, was exhibited to the four following sensitives, at various times, alternately in air and in water. Madame Kienésberger saw the flame four-fifths of an inch long in the air. As soon as I dipped the horse-shoe under water both smoke and flame immediately vanished from her sight, but the odic incandescence persisted, and the steel was luminous as it lay in the water. Moreover, according to her account, a small brightly luminous point remained on one pole, brilliant, but very minute. Friedrich Weidlich saw the polar flames two inches long in the air; I then let him immerse them in water, in a glass dish. He saw the steel continue in unchanged odic incandescence, almost as transparent as the glass itself, but the odic flames vanished instantly the magnet was submerged. At the same time, he assured me that the flame did disappear entirely, but a little point, as if on a corner, was permanent, and remained very bright. As often as the magnet was taken out of the water it again appeared, though still dripping wet, to be furnished with odic flames two inches long, and as often as it was replaced in the water these vanished, leaving only that little brightly luminous residuum. Miss Atzmannsdorfer, in whose presence I went through the same experiment, saw the magnet instantly lose its flame in water, but retain its odic incandescence, weak at the bend, but gradually increasing towards each pole. The healthy girl Zinkel laid a horse-shoe in water, the two flaming poles turned towards the north. Flame and smoke vanished instantly. When she took it out again they returned to both poles without their having been dried. On the other hand, the entire magnet remained odically incandescent in the water, the intensity of its light not being at all weakened. At the same time a strong appearance of light, like a residuum of odic flame, of concentrated brightness, remained upon one of the poles. The fiery

point was at an inner corner, that is, one turned towards the other poles; from it issued also an exceedingly delicate fiery streak; when this was accurately felt out it proved to be the inner transverse edge of the same pole; that is, the one lying nearest to the opposite pole. I marked, in the dark, the pole which retained light at the edge and corner under water. When I brought this into the light, it unexpectedly proved that this was not the magnetic pole, as I had conjectured, but the *positive*, *the southward*, pole of the magnet. It was doubtless the same on which Madame Kienesberger and Weidlich had perceived a residuum of odic flame in a concentrated condition. In frequent repetitions of the experiment, especially during menstruation, she perceived remains of light also on the southward pole, but less striking and less perceptible, because they were blue and greyish blue, and had less intensity, while the residual light on the southward pole appeared reddish yellow; and sometimes red like glowing charcoal.

484. Thus a denser medium, like water, removes the odic flame and smoke, it may be, by absorbing both, and thus becoming magnetized water; or it may be that it does not allow of the production of either to greater extent than as a luminous point and a luminous thread on the inner corner and edge of the poles of a horse-shoe. Our attention has already been called by Miss Nowotny (§ 3) to such luminous threads on the poles of the magnets, as the smallest degree of magnitude of odic flame.

485. I have not applied media of a third kind of density, namely, solid bodies, as materials for enveloping magnets. It would be an experiment well worth trying, to exhibit to a sensitive an induced magnet fused into an envelope of glass of tolerable thickness; I have not hitherto been able to do it. As it would lose its magnetism at the temperature of melting glass, it would be necessary to re-magnetize it from without, which would not be a matter of any difficulty. Experiments approximating to, but yet deviating somewhat from the fundamental idea, I have made with copper wire. I set out with the view of inquiring whether the transfer of Od—which, as we learned formerly at § 45 of the second Treatise, may take place from magnets on to other bodies, and which we made acquaintance with through its influence on the sense of feeling—might not perhaps also find an expression in the phenomena of light, and thereby be made capable of leading to further conclusions on this profound subject. With this intention I made a loose irregular coil of about ten to fifteen turns of copper wire one-twelfth of an inch thick, so as to form a kind of net, pressed it flat, and laid it upon the northward pole of a nine-layer horse-shoe standing upright, fitting it to this to a certain ex-

tent, and allowing the end of the wire to project eight inches free at the side towards the east. When this was done in the darkened chamber, in the presence of Josephine Zinkel, whose eyes had been well prepared, as soon as the wire coil was placed in the middle of the eight inches high blue odic flame this immediately contracted, did not extend beyond the metal coil, but was evidently absorbed by it. On the other hand, the wire rapidly increased in the strength of its odic incandescence, became much more luminous and as if transparent. After a few seconds, this increased so much that it formed a bright atmosphere around it, a delicate, misty luminous envelope, which appeared to coat the wire all along to a thickness of about an inch. Immediately after, a light flame rose from the point of the wire, the luminosity of which was much more intense than that of the blue flame which the pole of the magnet possessed at first, so that it illuminated the neighboring floor of the room for the space of more than a yard. It was almost eight inches long, and exhibited a streaky composition, like a brush of light, such as has often been observed on the magnet itself, and which therefore appeared to have been transferred from this on to the wire. The magnet itself here lost nothing of its odic incandescence, only its odic flame. I went through a similar experiment, with similar results, with Miss Atzmannsdorfer, but do not find it recorded in the journal I kept with her, and therefore cannot give any of the details of it. On the other hand, the experiments with Madame Kienesberger are accurately reported. I brought a wire, several yards long, under double doors and carpets, from a room which daylight entered, and where an assistant was placed, into the completely darkened chamber, and I here placed the sensitive before it. I now directed the assistant to apply the negative northward pole of a five-layer horse-shoe to the end of the wire in the light room. After the lapse of about a minute, the portion of the wire which reached into the dark chamber began to increase perceptibly in odic incandescence; it slowly but continually became brighter, till, after four or five minutes, it attained its maximum of incandescent light, in which it appeared transparent like glass. Along the wire, scattered points of fire-rust were formed here and there, almost like sparks, but larger, duller, and more permanent. They appeared to move backwards and forwards a little, and to increase and diminish in size and intensity of light. When blown upon they were extinguished for a moment, but were immediately reproduced. At the point of the wire appeared a luminous patch, also bluish, somewhat larger than those points, more strongly withstanding currents of air, and more luminous. When I had the southward instead of the northward pole of the magnet applied to the end of the wire in the outer room, the luminous phenomena all gradually appeared in the dark chamber in like manner; all smaller, however, and with the light duller. These phenomena were evidently completely correspondent to those Josephine Zinkel had observed, and only weaker in proportion as the magnet was smaller, and the length of wire brought in contact with it shorter. The luminous spots here and there on the wire were the rudiments, the first piecemeal appearance of that envelope of light which we have already found Madame Kienesberger perceive. I modified the experiment with Friedrich Weidlich by rolling up the end of the wire in the lighted room, into a coil of several turns, and then having the northward pole of a nine-fold horse-shoe applied to this. Thus, the surface of contact was increased, and the magnet stronger. In the dark chamber he saw the odic incandescence of the wire increase, and a slender flame, eight inches long, and as thick as one's finger, rise from its extremity; when I had the southward pole applied, a shorter, duller, and rather broader flame appeared on the end of the wire; all agreeing with what has already been reported, and differing only in the greater intensity of cause and effect. With Madame Kienesberger I placed another copper wire, not rolled into a coil, but merely the end of it, on the nine-layer magnet, in the dark chamber. On the northward pole, the copper wire, one-twelfth of an inch thick, and one yard long, became more strongly incandescent than before, diffusing light around; a flame appeared at the other end, which she compared in stillness, size, and aspect, to the flame of a wax candle, slender, rather yellow below, more bluish above, conical, and with smoke ascending more than four inches high above it. When I laid the wire on the southward pole, the phenomena which successively appeared were the same, but rather weaker, smaller, and less luminous; the terminal flame was now red and smoky. The progress of the phenomena was just as before, slowly rising one by one from the source, increasing, and then disappearing again after the wire was removed from the magnet. In a subsequent third experiment I used the coil of wire with her also, and in the same way as with Zinkel, only with the slight modification that I made the projecting free piece of wire a full yard long. When I had applied the coil to the northward pole, the blue flame of this immediately sank down, only a small remnant of it remained playing among the turns of the wire; these had apparently absorbed all the rest, that is to say, absorbed the force which produced the flame. The odic incandescence of the wire consequently increased; it soon acquired an envelope of thin, misty, luminous nature over its whole length, emitting bluish light, and coating it almost to the thickness of one's finger, without visible motion; at length, a flame four inches long rose from the end of the wire, pale-yellow below, and blue above, terminating in a stream of delicate luminous vapor. When I took the wire coil away from the northward pole, all this vanished immediately, the flame rose up from the pole to its former height, and all returned to its original condition. Then, bringing the wire coil to the southward pole, similar appearances presented themselves here also: the red polar flame was immediately absorbed by the copper wire, and vanished from the pole; the pale natural odic incandescence of the wire changed into dull red; a red, luminous, misty envelope, three-fifths of an inch in thickness, came up over it, and finally an odic flame, two inches long, burst forth from the distant end of the wire, red below and yellow above, pointed, and losing itself in dense and abundant smoke, which rose up above it.

486. These experiments, which I could confirm by the enumeration of many similar ones if it were necessary, all agree in teaching us that the *conduction of odic force through other bodies*, such as we have become acquainted with in many cases in the seventh Treatise, through the *effects on the sense of feeling* produced on the sensitive, *is also accompanied by corresponding luminous phenomena*; that, like the force which the magnet emits, and with which it impregnates other bodies, so, also, the flames which it sends out can be infused into other bodies and again emitted from them, exactly as from the magnet itself. *The transferable essence of Od, therefore, carries with it*, besides its power of affecting the animal nerves also, *its luminous force; and it carries over into other solid media, its incandescence, its flame, its smoke, with their fluidity, their mobility, their light, and their colors*, and, as we already know, in addition, their peculiar sensations of coolness, warmth, uneasiness or refreshment.

487. A retrospect of the various contents of this chapter shows us that the phenomena of light proceeding from the magnet, incandescence and flame, are developed most strongly, in greatest size and luminosity, in highly rarefied air,—perhaps would be still more perfectly unfolded in an absolute vacuum; that odic smoke appears to have its greatest intensity connected with a certain definite density of the air, beneath which it begins to disappear again; that the common density of atmospheric air considerably diminishes the odic luminous phenomena; that the density of water so restrains the odic flame that it almost annihilates it, yet without lessening the odic incandescence; that the density of solid bodies, like glass, (the bell of the air-pump,) absorbs it, and retains it to a certain extent by its coercive power; but of such as metals, especially wires, readily emits the absorbed essence again in luminosity and flame, both along the

surface, and, more particularly, at points. To comprise this in a word: *that the odic light is subject to different conditions in different media.*

488. So far as we can at present see into the matter, there is some probability that odic smoke is *odized air*, in the same way that the so-called magnetized water is *odized water*,—that is, air and water charged with Od. For water also, when odized, whether by the magnet, crystals, hands, chemical action, or any other means, acquires odic incandescence, and becomes visible in the dark, although previously invisible, exactly as odized metals acquire or increase in odic incandescence; which will be more minutely shown hereafter.*

Colors of Odic Light.

489. The phenomena of the colors exhibited by the different kinds of odic light acquire very great consequence as they are more minutely inquired into. From my further researches, it proves that they are not accidental and irregular, as they would appear to be from the earlier ones, but that they are subject to ordinary physical laws, and, consequently, that their gradations may thus be used as a

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* Clairvoyant persons have repeatedly declared to me as a fact, the proposition contained in this paragraph, substituting our accepted word *mesmerized* for *odized*. They say air or water is "thickened" or made cloudy by what they call the *mesmeric fluid;* and sometimes, as it has emanated from different individuals, the color has been different—from one, deep blue; from another, silvery blue; from a third, green. In some of Major Buckley's cases, persons wide awake have seen the light produced by his passes to be blue; some have seen them green. These were delicately sensitive persons, who have in my presence read printed words and sentences on slips of paper previously concealed from them carefully in another apartment, in the innermost of a nest of four silver boxes, all enclosed in a morocco case, or folded up in nutshells.

Such facts would lead us to conclude that the conditions of organization introduce relations into the subject of color that require much careful investigation. The perceptions of clairvoyants on the colors emanating from metals are so much in accordance with the facts developed in the very careful and curious researches of the Baron, that new views may arise on the theories of color. Our faculties of perception depend upon our organizations. From these emanate odic or mesmeric forces. Many individuals who can see very well, cannot distinguish colors. The organ of color is wanting in these persons. No fact in Gall's magnificent discoveries is better established. Color, then, is dependent on the odic force emanating from Gall's organ of color. Is color dependent essentially on further relations of the odic force? Have we not differences in the perceptions of color as emanating from chlorine, from iodine, from cobalt, from copper? May not color be dependent on a crystalline arrangement of an elementary ponderable with lumine and odine? The grasp of chemism on other sciences is not yet defined; and the influence of further researches into molecular forces may yet widely illuminate other spheres of knowledge.

measure, on the one hand, of the polar quality and the strength of the development of Od: and, on the other, of the degree of excitability of the sensitive; not to speak of the most interesting deductions they afford us respecting magnetism proper and its intimate characteristics. In its lowest and weakest stage, the odic light appears upon the magnet as a faint greyish cloud, only perceptible after a sojourn for hours in absolute darkness, and the reality of which can only be ascertained by slowly moving the luminous body, the magnet, to and fro in the dark. A pocket horse-shoe of strong magnetic intensity was thus seen by the healthy Mr. Edward Hütter: the luminosity was so faintly grey at the northward pole, in the blackness of night, that for a moment he was in doubt whether what he saw was real or the effect of imagination; but when the magnet was moved backwards and forwards, he saw the grey light traverse the same path, and thus became convinced of the correctness of his observation. This case occurred frequently with many of the less sensitive, always at the commencement of the experiments, especially with the healthy Baroness von Natorp, Madame Josephine Fenzl, Messrs. Tirka, Kotschy, Schuh, Delhez, &c. I omit further instances, since these have been mentioned often enough incidentally elsewhere.

490. This original delicate grey light, at first perceived only at the northward pole, becomes stronger in its ascending stages. In the first place, it becomes more distinctly visible, gradually more dense, more vaporous and concentrated. A cloud also appears at the southward pole. Both gain strength and consistence until they resemble smoke.

491. A period now soon comes, in which color begins to appear, at first only dull, and faintly tinging the general grey. Madame Josephine Fenzl saw only a cloudy light over the electro-magnet; but at the northward pole it seemed, in comparison to that over the southward, more of a bluish grey, while the latter was rather yellowish grey. Professor Endlicher gave the same account of some horse-shoes. This is the very commencement of the perception of color. Proceeding onwards, a portion of the smoke, that which is in contact with the steel, acquires a flame-like continuity; the other part in which the flame loses itself, remains smoky. Mr. Sebastian Zinkel (77 years old,) saw, rising from the northward pole of a single horse-shoe magnet, a bluish appearance, which he was doubtful whether to call flame or smoke; at the southward pole he discerned a similar smaller but indistinctly smoky emission of light. The smoke is strongest and most dense at that part where it is in contact with the point of the flame, and gradually passes, with dimi-

nishing density, at the other end into vapor and mist, and thus, becoming continually weaker, is at last invisible; this is always in the upward direction. The flame-like lower portion now gains more color. It is first seen, when the poles are directed upwards, that at the northward pole the grey begins to grow yellowish or bluish, and with increasing strength it passes through blue-grey into yellow or blue. The southward pole frequently only possesses smoke at a time when the northward pole has long shown a blue flame. Finally, the smoke reaches at the southward pole the degree of strength at which it passes into flame; the grey inclines at first into whitish-grey, then into yellowish-grey, and rises through yellow and orange into red. The smoke over the red is by this time at a very dense, increasingly densely rolling stage, in which finally scattered sparks, like fire-flies, float about. If, however, the poles are directed, not upward, but downward, or in any other direction, these conditions follow a different course. (I shall speak of this immediately.) The red flame of the southward pole, though appearing later, possesses the greatest intensity of light; the blue of the northward pole is always less luminous, and, when the two present themselves side by side, in tolerably *equal size*, the blue is always dimmer, the reddish-yellow and red brighter: where this, as usually happens with horse-shoe magnets, appears to be reversed, it depends merely on the fact that the northward flame is larger under our latitudes than the southward flame, and therefore appears relatively more luminous. This course of the phenomena was observed, in all its gradations, by the sickly sensitives, especially by Madame Kienesberger, Misses Winter, Dorfer, Kynart, Weigand, Krüger, Miss von Weigelsberg, Madame Johanna Anschütz, also by Freidrich Weidlich and others, and by the healthy Messrs. Pauer, Gustav. Anschütz, Tirka, Schuh, Kotschy, Rabe, Dr. Nied, Stephen Kollar, Baron von Oberländer, Klaiber the joiner, Miss Sophia Pauer, Professor Endlicher, Miss Ernestine Anschütz, the Baroness von Natorp, Mesdames Josephine Fenzl, Isabella von Tessedik, von Varady, von Peichich, Cæcilie Bauer, the Baroness von Augustin, and others. I consider it superfluous to enter upon an enumeration of countless single experiments, of which incidental mention is made everywhere, for the support of these most clear phenomena, which may be repeated and confirmed anywhere with any sensitive person.

491 *b*. I have already stated, in accordance with the accounts of Misses Nowotny, Reichel, Sturmann, Atzmannsdorfer, and Maix, that in the further progress these two principal colors become associated with others,—in fact, with green, orange, and violet,—and thus the odic flames acquires a variegated, apparently confused, play of color.

Professor Endlicher saw the lights over a strong electro-magnet moving about with an irregular intermixture of different colors. Baroness von Augustin expressed herself in the same way on this point; also Madame Kienesberger, Stephen Kollar, Madame von Varady, Freidrich Weidlich, Dr. Nied, Misses Winter, Girtler, Zinkel, and others; the latter frequently in the cases of bars and horse-shoes. All the more highly sensitive met with it in the first experiments on light, and expressed lively astonishment and delight at it; but, under equal circumstances, they saw it most distinctly beneath the air-pump. Miss Atzmannsdorfer saw the variegated play of color over a horse-shoe magnet, which she had perceived but faintly in the open air, become more bright and more vividly colored under the receiver with every stroke of the pump.

492. There is yet a higher stage of the phenomena of light, and this deserves the most accurate recital of the experiments, and the most circumstantial examination of their details. This is *a perfectly regular iris* or *prismatic spectrum*, the origin of which astonished me, and will surprise every one who takes the trouble to enter minutely into this remarkable subject. The variegated mobile play of colors is arranged according to certain rules, and is produced in definite forms when all conditions unite to favor its undisturbed development. As early as 1844, Miss Reichel had mentioned to me that she frequently saw a rainbow in the magnet-flame. I took no notice of this, under the idea that she meant merely a variation of color in the movements of the odic flame, something like what we are accustomed to in the sparks and brushes of the electrical light; but the statements of Miss Reichel have always subsequently proved to be correct.*

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* An *avis au lecteur* for the gentlemen of the so-called Vienna Medical Committee. It has occurred to me that it will perhaps not be altogether superfluous to those readers who are unacquainted with the journal of the Vienna Medical Society, to give a small specimen of the contents of the essay launched against my researches: this will place them in a position to judge for themselves what consideration it deserves. At page 50, for example, we find the following passage:—Dr. von Eisenstein led her (Miss Reichel) in this condition (supposed magnetic sleep) into a large room, where he allowed her to sit down upon a couch, and endeavored to raise her state to that of *clairvoyance* by passes with his hands and four bar magnets, and at the time to destroy the influence of the sun, and give the preponderance to that of the magnets. When he brought the magnets to the region of the heart, and Reichel started, as if involuntarily, he cried—"Aha! here is this nasty sun, then! It is on your heart! Wait a moment, and I will drive it out!" And then he made spiral turns over the region of the heart with considerable energy. The same scene followed in the magnetization on the back and the pit of the stomach. The sun was pursued without mercy, and driven out of every lurking-place. In one of these turns, Reichel jumped up and struck at her magnetizer; the latter pressed her into her seat again, and

Then Freidrich Weidlich asserted distinctly that the colors formed a perfect rainbow when the air was still, and the flame of the magnet

magnetized her lips with little circular passes. When she tried to oppose it, and held her hand before her face, he removed it, and reproached her, that "she would not kiss the magnet, her benefactor, who made her well; the horrid sun must be driven away from her lips, and its place taken by the magnet, &c." Turning over leaf, we find the account of an experiment in which Reichel was to see flames on magnets held before her in a room open to daylight, and when, as an additional means, her eyes were bound with a handkerchief: this ends with the words—"Dr. von Eisenstein (conductor of the experiment) gave no explanation of the tendency of this experiment. Baron von Reichenbach always made his researches on the emanations of light from magnets in darkened places, and found that they were stronger in proportion as the obscurity was more complete. Why Dr. von Eisenstein undertook this experiment in a room brightly illuminated by reflected sun-light,—why he chose the moment when her eyes were bound,—whether he thereby intended to test her gift of divination, or whatever else he wanted to show by it,—we know not: he gave us no explanation of the experiment just related." Nonsense of this kind is met with not unfrequently in the course of the treatise: who could find patience to follow two hundred pages of it?—*Author's Note.*

I must take this opportunity of expressing my admiration of the generous testimony afforded by Professor Gregory in favor of the truths of mesmerism, in his note occurring at page 356 of his translation of the Baron's researches. It is a service of some peril, in these days of literary and scientific ruffianism, to avow a belief in the statements respecting Miss M'Avoy; or in those recorded by Dr. Elliotson in various numbers of the Zoist, especially relating to the facts about the Okeys; or even his belief in the genuineness of the phenomena which Professor Gregory had himself observed in the case of Miss Martineau's servant-girl. It is well and nobly asserted by him, that "it is the duty of every lover of truth and of science, to protest energetically against the system of reckless accusations of imposture preferred against persons of blameless character, because their statements appear to us incredible, or, as has often happened, because we are unable, from want of knowledge of the rules of scientific research, to form a clear distinction in our minds between what is real, and what may be imaginary or delusive, in the results obtained."

In Vienna, the squad of *stupidities* who had undertaken to criticise the Baron von Reichenbach, have had recourse to the same expedients against one of the subjects of his experiments as the opponents of the truth had adopted in England. It is curious to remark the influence which competition exerts in modifying the moral perceptibilities of mankind. The struggle for pelf renders some men, otherwise of fine capacities for generous feelings, sordid and mean. Their organs of acquisitiveness, cunning, and self-esteem, are stimulated into undue action by the leading active minds of the coteries to which they happen to be attached. One man, perhaps, having nothing to recommend him but great activity in gathering gossip, albeit he may be in science, for his ignorance, the laughing-stock of every society of which he is a member; in practice, for his maladroitness, the slaughterer of the women he may be called upon to assist; in friendship, the backbiter of his greatest benefactor; to the poor, a brute and a ruffian; yet, if he can fetch and carry prurient tales, well paid for, and gathered from the lowest haunts of female iniquity, his falsehoods may be listened to and retailed in low whispers among persons *professing* high feeling. Gregarious man is long the was not broken up into fragments by the breath of bystanders. He gave me a rough account of the arrangement of the colors and their

victim of the fallacies among which he lazily wades in the struggling sea of life. How strange it would appear to a benevolent being of a higher order, if he were to appear amongst us, that, at hospitals, demonstrations have been given of the power of mesmerism to cure disease, to alleviate suffering, and to render painless the most frightful operations of surgery, and that *thousands* of facts attest these truths, and yet, that the professors of the art and science of medicine, have rejected, over and over, again all inquiry into the subject! How strange it would appear to that being, that no sooner had ether and chloroform been proposed to the same professors, than that, without much inquiry, these dangerous and deadly materials were hailed as important acquisitions to the medical knowledge of the age. The one agency, when studied, leads to a knowledge of the highest functions that belong to human beings, to more than a knowledge of the alleviation of suffering by innocent means; to a corroboration of those high scientific truths that tell us of the springs of human action, of the motives of human conduct; and that lead the humble philosopher to the conviction, that large charity is the necessary result of deep reflection on mesmeric facts. The other agency, allied to the nocent influences of narcotics on the human brain, leads to the destruction of health, either temporarily or permanently, often to immediate death! sometimes to the encouragement of robbery, even of murder, and of the most abject vices that can degrade the human character. What obliquity of intellect has possessed these professors of science? would be the natural question. Can they witness the deeply interesting facts Dr. Elliotson exhibited to them years ago, and not be stimulated to ardent scientific inquiry? Can the gloating of a few misers on the golden heaps of some of their fellows so obtund all feelings of noble honesty as to leave mesmerism, because it is tabooed by authority, uninquired into? Are fears for the fees and stipends of a few individuals forever to retard the progress of human knowledge towards a science of mental philosophy? Thanks to Dr. Elliotson, it is not to be so. The silly surgeons who, in their ignorance, so greedily grasped the murderous narcotics, like the savages who prefer the instruments of death and destruction to the quiet influences of progressive civilization, may build monuments of wealth to their destroying angel; may set up their golden calf, and worship their spirit of evil. They cannot succeed in crushing truth! and posterity will regard with pity their weak efforts to darken the world.

As to Dr. von Eisenstein, in the Baron's note, he is evidently one of the small fry of those who endeavor to accomplish the impossible feat of arriving at truth, and encompassing it by the force of imagination alone. Such persons are little aware that they call into play a combination of several organs of the brain opposed to the reasoning faculties, and which may lead the individual to conclusions as wide of just results as if they determined at once to judge without knowledge. In all probability, the *stupidities* who have been the slanderers of Miss Reichel, if they have paid any attention to mesmerism, have, to save themselves the trouble of inquiry, attached themselves to the sect who boast of their spiritualism. It will be unnecessary to repeat here the sources of fallacy that belong to ideas which must, in every way, tend to confuse the intellects. There are organs of the brain, which, when over stimulated, leave the individual a victim of ecstacy. The imagination, said to be a mental faculty, but, in reality, the result of a combination of the actions of several organs, if indulged in without regulation and very strict control by the intellectual forces about the forehead, may lead to an relative extent. He made the observation most distinctly in a three-layer horse-shoe of great intensity of magnetic charge. He was followed by Baron von Oberländer, who saw a regular iris over the same three-layer magnet. Madame von Varady observed this over the nine-layer. In like manner Dr. Nied, but with intermissions. Miss Atzmannsdorfer frequently described to me the beauty of the rainbows she perceived on the magnet, both on horse-shoes and bars. Madame Bauer gave me the most vivid descriptions of rainbow-like superposition of colors over the poles of all stronger magnets, in which she always found the red at the bottom, then yellow, green, &c., following upwards.

493. One experiment with Josephine Zinkel will serve for all. When in her ordinary healthy condition, she commonly saw the polar flames uniformly bluish or reddish over the poles of the nine-layer horse-shoe. When I showed her the same during menstruation, she saw them not only larger, but perceived the form of an iris in both, in which bluish color *predominated* at the northward, and reddish at the southward pole. This was the case when the horse-shoe stood upright, with poles directed upwards, and the arms conformable. But when I turned both poles toward the north, while the horse-shoe was laid in the meridian, the iris vanished from the southward pole, only a bluish grey red flame remaining, while on the northward pole the iris is increased to double, and attained a length of twenty inches. When I turned the poles of the horse-shoe to the south, the northward pole entirely lost its iris, retaining only a dull reddish, grey-blue flame, while the southward pole acquired a beautiful iris almost twenty inches long.

494. Even the mere terrestrial magnetism sufficed to produce the iris, and render it visible to excitable individuals. Madame Kienesberger, when menstruating, saw an unmagnetic iron bar, twenty-four inches long, lying in the meridian, emit a red flame towards the south and a blue towards the north; the latter, however, was not totally, but only predominantly, blue; and she detected, besides this, all the other colors of the rainbow, which possessed less intensity of light. The colors were so distributed that they appeared stratified from be-

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ecstacy as incompatible with rational conviction, as the open-mouthed fatuous wonderment of the idiot is with the higher calm reasoning power of the philosopher. Could man be brought to the conclusion that the numerous fallacies, the reiterated falsehoods, which have resulted from his imagination having conquered his reasoning faculties, are the causes of all the evils surrounding him, how ready would he be to abandon his errors! Alas! When is man to be enlightened to this extent!

low upwards. The lowest stratum was reddish, the next yellow; then followed green, and the uppermost was chiefly blue with violet.

495. The phenomenon was, however, more beautiful and more clearly marked on electro-magnets. Here I could not only heighten the phenomena, and render them more distinctly perceptible, but I had the advantage of being able to bring a single layer only into the experiment, and to avoid the manifold disturbances which arise from the reciprocal action of the separate layers of a strong compound horse-shoe. When I had produced an odic flame of a span high upon an electro-magnet, through the influence of a Smee's battery of one-sixth of a square foot, Madame Kienesberger was the first to inform me that the flame which she saw rise from the negative northward pole was not merely blue, but *yellow and blue*, the yellow color next the iron, the *blue lying horizontally over that*, and passing above into grey mist; at the positive pole she saw only red flame with dense smoke rising from it. In order to strengthen the electro-magnet, and perfect the experiment, I added another Smee's battery, having about a square foot of surface, to the former. The odic flame of the poles of the electro-magnet was now more than tripled: that on the negative pole was within a few minutes to about twenty inches; that on the positive to eight. The former now exhibited the interesting phenomenon of becoming a perfect prismatic spectrum, in such a manner that below, when it touched the horse-shoe, which stood with its poles directed upwards, it displayed to the eyes of the beholder a red layer; this was followed by an orange-colored, then a yellow, next a green, a bright blue, dark blue, finally an uppermost violet blue, and grey vapor above this. At the same time the positive flame of the southward pole presented a blood-red color next the iron; then came a light red layer, at the top an orange-red, which lost itself in thick, heavy, and opaque smoke rising up to the ceiling. She described the appearance as of extraordinary delicacy and splendor, and was filled with delight and amazement at it, like her predecessors in similar cases. She found the intensity of the colors greater than that of any permanent magnet. Some weeks later I went through the same series of experiments with Josephine Zinkel. She described the phenomena to me all in the same way as Madame Kienesberger, whom she about equals in degree of sensitiveness, and she added the complementary note that the prismatic colors individually are not simple, but that each appears in distinct shades, and thus seems to be composed of several, whereby the entire spectrum is ultimately composed of a great number of superincumbent colored streaks of light. She also described a *narrow streak of pure red* above the violet-blue, the violet, becoming gradually redder, passing into this above, and this

then going off into smoke. She already perceived the iris when the magnet was first induced by one Smee's element of one-sixth of a square foot, but the colors were dull and indistinct, so that she could not give a certain account of their characters at that time: thus she believed she could perceive a light blue between yellow and green; but when I added a battery of six Smee's elements, all the colors became incomparably more luminous, clearer, and perfectly distinct, under which circumstances the imaginary blue was found to be a transition tint between light yellow and light green. This experiment cannot be made successfully with weak electro-magnets; mine measured one foot in the length of the arms, and the iron was an inch thick. This experiment was repeated, with the same results, three months afterwards.

Again, a few months later, I applied a Smee's apparatus having two and a half square feet of surface. The prismatic spectrum was developed splendidly to a height of more than a yard, and with smoke that rose to the ceiling and lighted it up. The appearances at the negative pole were again the same, only on a large scale and more brilliant; but the iris was likewise better developed at the positive pole; blue was now added above to its red and yellow colors. By greater exaltation of the electro-magnet, the green and violet-blue would certainly be rendered visible. This experiment was also repeated some months subsequently.

496. The boy Stephen Kollar also saw the colored appearances in the flame of the electro-magnet. Since he had no idea whatever of what was going to appear when I allowed the powerful voltaic apparatus to act upon the polar wires, he was very much excited by the progress of the phenomena, from the odic incandescence to the prismatic spectrum, and its gradual increase to a variegated flame, appearing to him twenty inches high, with smoke above whirling up to the ceiling.

497. Professor Endlicher did not see a regular steady iris over the electro-magnet, perhaps because time and leisure enough were not afforded in the experiment; but still he detected different colors in the odic flame; below (namely in the seat of the red) it was indistinct and dark; above this he saw yellow, next green, and lastly, above, blue mingled with violet, unsteady certainly, but, on the whole, displaying order of colors of the rainbow to him as to all the other observers, although less perfectly developed.

498. I brought Wilhelmine Glaser, during the catamenia, to the same electro-magnet, with the current of two Smee's batteries passing through its coils. She beheld the flame over the negative pole, predominantly blue, about four and a half feet high, that of the positive

pole half the height. The smoke from them rose to the ceiling. Both the polar flames again produced the beautiful iris; the negative with all the prismatic colors, *with a short portion of red succeeding to the blue above*, terminating in smoke, but the positive flame was only red and yellow; the latter of which lost itself in the dense smoke.

The chlorotic Anka Hetmanck also saw a larger odic flame over the electro-magnet than over the nine-layer horse-shoe, and this was red below upon the magnet, the prismatic colors then following, upward, to blue and blue-red, which merged into smoke and so rose to the ceiling.

499. Madame Cæcilie Bauer (during pregnancy) described the large electro-magnet most brilliantly. She saw nothing over the poles of the horse-shoe before it was connected with the Smee's apparatus; she stated it to have merely the whitish odic incandescence of all metals. But as soon as I had connected the polar wires of the two batteries with the thick wire coil, she saw the flames rise over both poles, small at first, then increasing, and continuing to ascend till they were half as high as the room. Then they passed into smoke, which came in contact with the ceiling. (Neither of the Smee's batteries worked at all well on the day of experiment; they were very weak). She saw blue predominate at the northward pole, and red at the southward: but at the same time the flames of both poles were most beautifully prismatic. She even perceived the iridescence on other portions of the arrangement, on the electro-magnet itself, the Smee's elements, and other parts, of which more will be said in its proper place.

499. *b.* On various occasions I placed a seven-layer horse-shoe magnet, with the poles turned upwards, in the vicinity of the conductor of the electrical machine, and showed it under these circumstances to Josephine Zinkel. She saw the usual appearance of red and blue flames over the poles. But directly I set the machine in motion, so that the magnet was placed in *the electrical atmosphere*, not only did the flames increase in size and intensity of light, but they each changed into an iris, in which the blue at the northward pole, and the red at the southward, were now only the prevailing and no longer the sole colors. The blue was here found to be the stronger; the red the weaker and duller; the first situated at the top of the iris, the second at the bottom.

500. In all these cases, the iris was seen horizontally stratified, *the colors lying one above another in horizontal layers; the red color was always at the bottom, the violet-blue always at the top.* This relation to the terrestrial magnetism must be kept in view. During

the first minutes, while the colors are being developed, they are mingled unsteadily together; they gradually arrange themselves into the form of a floating iris. This does not take place rapidly, but with remarkable slowness; and in the above described experiment, four, five, to six minutes, were required for the production of the perfect iris over the electro-magnet.

501. It results from the above facts, *that the odic flame of the magnet does not consist merely of red and blue, at the two poles, but of an iris or primitive spectrum at each, in which blue is but the predominant color at the negative side, and red the like at the positive.* They become visible when magnetism and Od attain a certain strength, and remain invisible, or limited to a single color, when those forces are weak, or the perceptive power of the sensitive beholder is of low degree.

502. But we have another complicated compound kind of iris to examine, in addition to this simple one.

Here and there in the experiments, as we have already seen several times, a certain *variableness of the odic color* has announced itself, frequently threatening to render the results uncertain. I was hereby induced to undertake a long special inquiry in this direction, to carry it attentively through a vast number of experiments, and to endeavor to obtain the laws of the phenomenon. I will here merely bring forward the most essential of the results.

503. When I placed a magnetic bar with poles in the direction of the dip, it always emitted different colors from those it gave in the meridian; and when a northward pole was directed towards the north or towards the south, its odic flame displayed at one time more of a blue tint, and at another more of a red and grey. Another uncertainty accompanied this: when I turned a northward pole upwards, the beholder generally found it bright blue in the dark, sometimes again grey, and not unfrequently even yellow; with more of the like incongruities.

504. Seeking the causes of all this, I began by setting out from the idea of a possibility of subjective variableness in the perceptions by the sensitive. I placed a magnetic bar two feet long in an upright position, with the northward pole directed upwards. When weakly magnetic, and examined by the girl Zinkel in the dark chamber at a distance of eight inches, it appeared to her opaque, and of an indistinctly greyish-yellow; when she tried at what distance it displayed its color most clearly, and its general form most distinctly, to her eyes, it proved in every experiment that this was about from seventeen to twenty inches; then it appeared of a pure yellow; going further back, she saw this clear yellow soon become indistinct

again, a shade of bright grey, not unlike sky-blue, was infused; but on removing further away, this changed into full, unequivocal grey, which, on a retreat to a greater distance, grew duller, less perceptible, and from forty inches, and over, vanished.

505. Making the same experiment with Miss Sophie Pauer, I arrived at the same results, with the slight modification only that in her the distance of vision for distinct and yellow odic flame did not amount to twenty inches, but only to about eight, and that she found it become bluish directly the distance of her eyes from the luminous object increased beyond this. Miss Pauer, however, is short-sighted; consequently, this peculiarity influenced her odic vision, and showed to what a great extent the apparent variation of the color of odic flame at different distances is a mere subjective phenomenon.

506. These observations, made in all directions and in the same manner, and repeated at various times with unchanging results, on Josephine Zinkel, furnished the proof that there is only one definitely fixed distance, different for the eyes of each person, at which the color of the odic flame is seen purely and distinctly; that *it always remains the same, and has no variableness at this distance, for each individual; but that at other distances, less or greater, it strikes the eye with other tints*, dull yellow when nearer, bluish-grey and grey when further off, and that consequently, in order to avoid confusing the appearances, the eye of the observer must always be kept at one particular distance.

507. In fact, I had been every now and then very much puzzled, before I thought of the last investigation, one observation furnishing sky-blue, and another, made under conditions apparently altogether identical, grey or yellow color of the odic flame. While one is involved in such a complication, the researches, in which the facts cannot be perceived by one's own senses, but must be obtained by questioning in the dark another person who does not understand the matter, become wearying to an indescribable degree, and it occasionally required all the attractions of so interesting a subject to support my patience.

508. Once master of this, perhaps insignificant looking explanation, (but the want of which opposes an inevitable obstacle to further inquiry,) a portion of the road was levelled, and I began a wider investigation of the variableness of the colors of odic flame, from the objective point of view. I fixed the same two-feet long magnetic bar by its middle in a Guidino's holder, which had a joint at the top rendering it moveable in all directions. I brought it lengthways into the magnetic meridian, conformably toward the north pole, at first turned to the north, and afterwards inclined at about 95°, in the

dip of Vienna. Starting from this, I made the northward pole pass through the complete vertical circle, which could be described around the axis of the magnetic bar in the plane of the meridian.

I carried this into effect in the dark chamber,—first in the presence of Josephine Zinkel, who observed the changes developed from the west onward in the progressive motion of the northward pole. From the perpendicular direction downwards at 0°, she saw the odic flame run through the following series of colors :—

At 25°	(in the line of the dip)		pure grey.
“ 45°	(ascending toward the north)		a narrow red streak.
“ 67°	“	“	violet blue.
“ 90°	“	“	dark blue.
“ 110°	“	“	light blue.
“ 127°	“	“	dark green.
“ 145°	“	“	light green.
“ 163°	“	“	greenish-yellow.
“ 180°	“	“	light yellow.
“ 200°	“	“	golden yellow.
“ 225°	“	“	orange.
“ 247°	“	“	flame-red.
“ 270°	“	“	red.
“ 290°	“	“	deep, intense red.
“ 325°	“	“	greyish-red.
“ 360°	“	“	reddish light-grey.

To make these more distinct, I give a diagram of them collected into a circle (Fig. 20.)

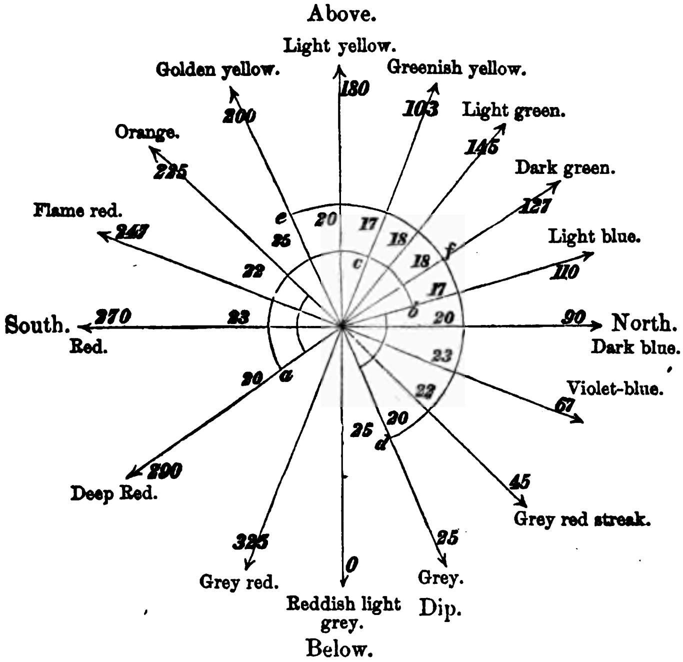
509. Examining the order of the colors of this circle, we discover a new iris, and in fact one with the colors lying in a circle.

510. It is peculiar that the very direction in which the greatest magnetic intensity occurs, namely, the magnetic dip, or inclination of 65° to the horizon, is exactly that in which all the colors disappear, and nothing but dark grey remains. Is this grey to be taken as white, that is, a compound of all the colors, or as black, the absence of all ? Hitherto I have been unable to clear up this with certainty : new researches will soon decide, but I am inclined to conjecture that the latter will prove to be the case.

511. It is also remarkable that the colors standing diametrically opposite to each other are *not properly complementary colors :* for red here stands opposite blue instead of yellow, and flame-red, instead of green, opposite violet-blue, grey instead of blue opposite yellow, &c. The circle is divided into sections of 90 degrees, the zero of which must be fixed at the dip. Opposite this, at 180°, stands yellow ; at each side, both at the distance of 90°, red and blue are situated opposite to each other, so that these again are 180° apart.

If we were beneath the magnetic equator, where the polar direction and the dip of the needle coincide, the direction and arrangement of the colors would be different. I hope I may live to hear of this experiment being performed there; it cannot be a matter of great difficulty, for scarcely an European ship can pass the line in which one or other of the crew is not sensitive.

Fig. 20.



512. Another singularity of a peculiar kind presented itself in the circumstance that the beholder constantly described what she called *a narrow red streak between the grey of the dip and violet-blue.* I had already met with this phenomenon in other cases. Madame Kienesberger frequently assured me that the iris, which presented itself to her with the greatest clearness over the electro-magnet, passed above into a narrow red streak, which then gave place to the smoke. Wilhelmine Glaser, also Stephen Kollar, Madame Bauer,

and Miss Sophie Pauer, gave the same report. It appears, therefore, as if the red was again so fully extricated from the blue or violet as to reappear once more as an independent color at the other end of the series, and consequently *red closes the spectrum on both sides*,—certainly at least the odic.

513. *Those colors which lie in the lower half of the circle*, namely, within 90° on each side of the dip point, *display remarkable difference in intensity of light from those of the other, upper half*, occupying 90° on each side of the golden yellow. The upper half, in the arc *a c b*, appeared bright, very luminous, fresh, and brilliant; while the lower was dull, opaque, and emitted little light. *The greatest intensity of light lies in the golden yellow*, the *greatest obscurity in the grey of the line of dip*. One might call the upper half the *day side*, the lower, where almost all the colors are veiled with grey and overcast, the *night side*. *The yellow color*, therefore, which we otherwise know to be the most intensely luminous in the spectrum, *represents noon, blue and red the two twilights, grey the night. The earth's surface corresponds to the heavens in its influence upon the odic flame of the magnet.* (Vide §§ 536, 356.)

514. I expected a great change in the colors of these luminous appearances when I used the southward pole of the same magnetic bar, instead of the northward, in these experiments. But the result did not confirm my anticipation. In the principal points, it was almost indifferent which of the poles of the magnet I made pass through the vertical circle. The distinctions were confined to a few insignificant modifications in the lesser particulars. The colors, which displayed themselves nearly equal in the same direction at the two poles, always appeared rather retarded at the southward pole, in the progress of the pole from the dip point to the north; I was always obliged to move the bar a few degrees further onward, to obtain from the beholder the modification of the same colors which had appeared at any given degree at the northward pole. This retardation of the southward pole occurs in the same way all round the circle, so that even the grey of the dip was at a smaller angle with the horizon than that of the northward pole. Vide § 334.

515. Moreover, the northward and southward poles of the magnetic bar are again divided into two other principal regions of greater and less purity of color. *From the dip forward, on the north side, to the golden yellow, upon the arc e, f, d, the colors of the northward pole appeared purer and more distinct; from the golden yellow forward, on the south side, back to the dip, on the contrary, they were more degraded, indistinct, and overcast. Exactly the reverse was the case with the southward pole;* from the dip, over north, up

to golden yellow, that is in like manner on the arc *e*, *f*, *d*, Josephine Zinkel described the colors as dull and misty; on the other side, from golden yellow, over south, down again to the dip, as pure and clear. Upwards at the yellow their appearances merged; they were most strongly manifested in the directions of the terrestrial poles. It is evident that the conformity or nonconformity of the position of the poles exerted their influence here, as everywhere else, and the northward pole, which could act with full force toward the north, was brought into conflict with the opposition of terrestrial magnetism, when turned to the south, and thereby weakened. Its red odic flame was consequently troubled and overcast in the southern direction by a portion of blue produced by its own magnetic but opposite polarity, and intermingled with the red; hence a red which was described to me sometimes as bluish-red, at others as greyish-red. The same holds good of the southward pole, the direction and the expressions being reversed.

515. *The circle of colors was thus twice divided into halves, through external influences, in respect to intensity of light and purity of color; once by a relatively horizontal, the other time by a relatively vertical section; in the one case principally influenced by terrestrial magnetism, in the other by the polarities of the magnet.*

517. None of the single odic flames ever displayed an iris to Josephine Zinkel, but appeared simply of one color. The most important of these researches were repeated with Madame Cæcilie Bauer, and afforded still more complete results. When I showed her the same magnetic bar, free at both poles, and fixed at the axis in the moveable holder, in the meridian, in the dark, she found it to have longer flames than Josephine Zinkel had seen, more than half as long again, and *not now of one color, but always in the form of an iris, excepting when placed in the direction of the dip.* Here she perceived merely dark colorless grey issue from the northward pole of the magnet. When I began to move it upwards toward the north pole, she soon saw the flame acquire an iris, at first a dull, but gradually becoming more vivid. *But one of the many colors here always displayed very much greater size, strength, and intensity of light, so far as to surpass all the rest, and to predominate so much that unless close attention was paid, the observer only noticed this one prevailing color.* Without reference to the constant presence of this dull iris, she described the changes of color in the circuit in the following order: first, when I had moved the northward pole of the bar a little out of the vicinity of the line of dip, upwards towards the north, a short red place, which soon changed into violet-blue, and next with the approach toward the north and the arrival at this direction, first into

dark, then into light blue. Between the north and the uppermost point, or zenith, I moved the bar, according to her accounts, through different shades, first of bluish-green, sap-green, and greenish-yellow, and, at the top, came to pure yellow. Golden yellow appeared diametrically opposite to the dip point. Downwards to the south, on the other side, red became intermingled with the yellow, increasing continually to the neighborhood of the southern direction, when red, with the admixture of a little blue, appeared almost pure. When I passed onwards over this, and inclined the pole further downwards below south, gray joined the red, increasing as the latter disappeared, till at length, in the dip, this, with all the accessory colors, completely disappeared, and gave place again to the simple and pure gray from which I had set out. This arrangement of the colors evidently agrees with the statements of Josephine Zinkel. The difference between the two beholders lies merely in Josephine Zinkel seeing but one color in each position, while Madame Bauer perceived everywhere a principal color associated with all the other prismatic colors, although these were very faint. This distinction is very simply and satisfactorily explained by the different powers of sight of the two observers. The girl Zinkel, with weaker vision, saw only the temporarily prevailing color; Madame Bauer, with stronger vision, saw this of greater size, and with it the other prismatic colors. (We shall meet with an instance in crystals, when Zinkel stood exactly in the same relation to Wilhelmine Glaser as Madame Bauer does here to Josephine Zinkel.) According to this explanation, Madame Bauer's observations afford the most complete confirmation of those of her predecessor, in numerous and frequently repeated examinations.

518. After Madame Bauer I tried this experiment with the eyes of Wilhelmine Glaser, who saw odic light considerably weaker than Josephine Zinkel. In her usual condition she saw the magnetic emissions only blue, yellowish, or red: but when I introduced her into the dark chamber during the catamenia, she distinctly perceived the changes of colors as I moved the pole of the magnetic bar round in the circle. She hesitated now and then as to the intermediate colors; it was necessary to attend strictly to keeping her eyes at the proper distance from the pole; she sometimes mistook light blue for grey, pale-yellow for pale-reddish, and *vice versâ;* but after a few repetitions her definitive assertions always agreed with the colors which Zinkel and Madame Bauer had announced; she was quite divided, however, as to the grey in the dip, the blue at the north, the yellow above, and the red at the south. She found little distinction between the applications of the northward and southward poles;

there was merely rather more of a bluish tinge in the former case, and of reddish on the other.

519. Miss Sophie Pauer saw the same magnetic bar emit pure dark grey vapor from its north pole, at the dip, when turned upon its axis in the meridian; raised a little toward the north, it became, first, somewhat reddish, then red-grey, next violet, dark blue, and pure blue when horizontally pointing to the north; higher up, light-blue, then blackish-green, next light-green, and yellow at the top; in the declension towards the south, first orange, horizontally towards the south red, and downwards from these reddish grey, decreasing till it became pure grey again at the dip. These trials were made in the morning, while she was still fasting and in an excitable conditon; when I made the same experiments with her in the afternoon, after dinner, her perfection of colors was no longer so certain, and she was frequently deceived in the grey tints; her power of vision was not so acute as before.

520. I was desirous of going through these experiments with much weaker sensitives, to see how far the results would remain the same. Madame Josephine Fenzl had the patience to devote herself to them, and to remain imprisoned with her husband, Dr. Fenzl, and myself, for half a day, in my dark chamber. Made with the same instruments, and in exactly the same way, the experiments furnished the following circle, drawn according to her statements, described by the north pole in the plane of the meridian (fig. 21, next page.)

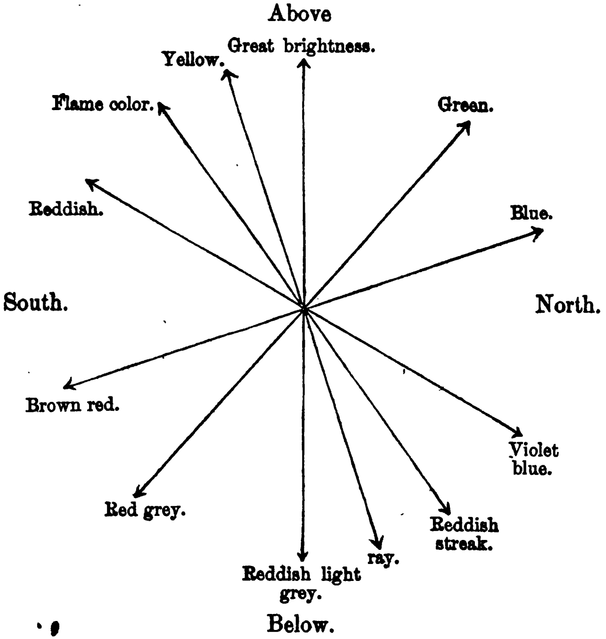
This agrees entirely with all the preceding; what is here called the lightest is the pale yellow of the last observers, brown red is their deep grey red, &c. No agreement could have been more complete.

521. In the last place I made the experiment with the still less sensitive Mr. Hochstetter. Under the same circumstances as his predecessor, he saw the northward pole of the magnetic bar, on the meridian, emit dark vapor towards the north; lighter and stronger above; densish and duller toward the south; darkest of all in the dip. His sight was not sufficient to determine colors; but the various intensities of light which he perceived corresponded accurately with the relative intensity of light of the different colors, which were named by the other witnesses; lightest above at yellow, darkest at the dip, dark at blue, &c. Even this weakest of the sensitives to whom I submitted this experiment afforded evidence for the accuracy of the observations with the strongest.

522. These results can be controlled by comparing with the above a single horse-shoe magnet placed in the meridian, with both arms directed one time to the north, the other to the south. When turned to the south, Josephine Zinkel, at a distance of two spans, saw blue

flames at the northward pole, and at the southward greyish-violet, and reddish blue with a turbid veil over them. Turned towards the south, she found the southward pole red, the northward bluish or greyish-red, likewise obscured; all four cases, therefore, exhibited agreement with the colors of the flames which are observed on the poles of bars under the same circumstances. Only single horse-shoes can be used for this experiment, because the flames of strong compound horse-shoes pass into visible iridescence with reversed intermediate layers, which alone already complicate the decision, as is shown at § 396.

FIG. 21.



523. When I made the experiment with the poles of the horse-shoe directed downward and upwards, the results were in great part such as I have already stated, but I must repeat them here in order to collocate and compare them. A horse-shoe with both *poles directed upwards vertically* and conformably, gave grey flame at the

northward pole, and reddish light-grey at the southward. In the direction of the dip the northward pole gave darker grey, the southward reddish dark grey. Raised a few degrees upwards towards the north, over the line of dip, the northward pole afforded grey with the entrance of reddish, the southward pole dark grey. The retardation of the southward pole, already mentioned, presented itself here also, in the advance from the dip toward the north: the northward pole, namely, already possessed dark grey flame, while the southward had not completely acquired it, and by the time the latter exhibited it the northward pole had already advanced to reddish grey, to the commencement of the red streak next the violet. When I turned the arms round, in the unconformable position, in the same direction, the results were again different as to the tints; as follows, indeed, without further detail, from the many experiments already discussed.

524. Lastly, a single horse-shoe magnet, *vertical and conformable, with the poles directed upwards*, always gave, at the northward pole, a flame which was described by the observer as predominantly grey, bluish or yellowish, according to the distance at which it was examined; at the southward pole a flame predominantly reddish-grey or yellowish-grey. At a distance of the eye of about two spans, and when strict attention was paid to the removal of all other influencing objects which might produce odic effects, Miss Zinkel, and many others, always found the northward pole predominantly blue, at greater distances blue, then grey. Madame Kienesberger, Misses Reichel, Atzmannsdorfer, Sturmann, Klaiber, also Weidlich, Baron von Oberländer, and others, frequently described it to me as pale yellow below and blue above, like the colors of the flame of a wax candle reversed: this was always the commencement of the iris. Under the like circumstances the southward pole appeared reddish-yellow below, and greyish-yellow above. These are all merely confirmations and applications of the facts before collected respecting the magnetic bar passing through the vertical circle in the meridian.

525. In order to see what proportion of all these results was to be placed to the account of the magnetic bar, and what to that of the effect of the terrestrial poles, I performed the same experiment *with an unmagnetized soft iron bar*. Having fastened it by the middle on the wooden holder, I brought it into the meridian, and turned it a quarter of a circle in the dark. In the first instance I showed it to Miss Zinkel. It presented some odic flame at each of its poles, but much shorter than those on the magnetic bar; they were but about a quarter or one-fifth of the length, and at the same time duller, with the colors more difficult to be recognised. Nevertheless, when I com-

pared the result of the iron bar with that of the magnetic bar, I found them essentially identical; the colors were similar in the order, direction, and succession; the angles alone under which they appeared varied a few degrees backward or forward. This difference, which, however, was but unimportant, is certainly wholly attributable to imperfections of observation. For although I left the observer to find for herself the point of greatest intensity of each color, it is impossible, until special instruments have been devised for the purpose, that this should be done so accurately that the statements should not vary a few degrees in so delicate a subject, and with light so exceedingly weak. It is sufficient that the results with the unmagnetic iron bar, produced by terrestrial magnetism alone, coincided perfectly in all essentials with those which had been obtained with the magnetic bar.

I subsequently made the same experiment with Madame Bauer. She perceived the colors quite distinctly and decidedly, but all duller and smaller on the iron bar than on the magnetic bar previously. The arrangement was the same,—grey in the dip, blue in the direction towards the north, yellow above, and red towards the south.

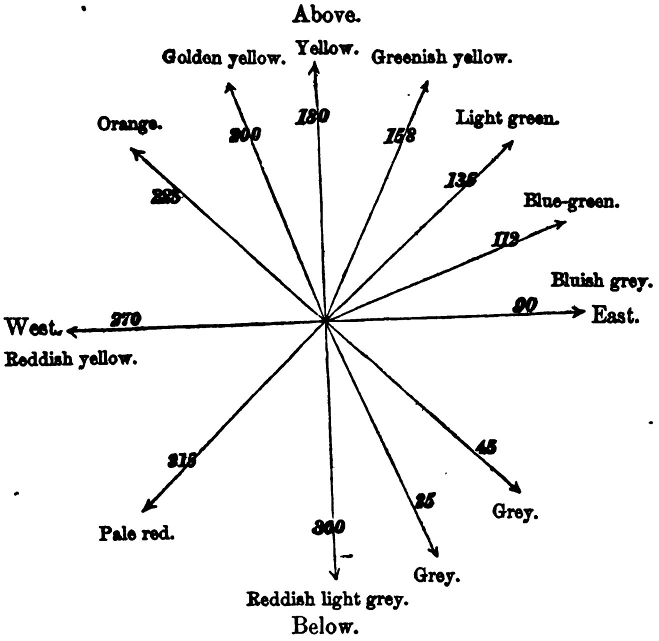
Miss Sophie Pauer also went through this task. She saw the iron bar emit grey vapor in the position of the dip; the same when turned vertically downwards; yellow-red toward the south; upwards pale yellow when near (pale bluish when she was at some distance), and towards the north blue; all the colors dull, small, and faint, so that she several times had difficulty in detecting the true color with certainty in the grey regions.

Even Wilhelmine Glaser gave favorable testimony for this less-marked experiment. I held before her in the dark an iron bar supported on the axis merely by the thumb and finger of my left hand. She perceived grey, blue, yellow, and red misty light in the corresponding directions, and even drew my attention to green between yellow and blue.

526. It thus appears that the circular iris exhibited by a magnetic bar at its poles and polar flames when made to revolve in its meridian, is also formed in exactly the same way, though more faintly, by a simple unmagnetic iron bar, and consequently it can be produced by the influence of the terrestrial poles alone. This affords an explanation of the results of the unconformable position of the magnet.

527. I now proceeded to investigate the behavior of the bar-magnet in passing *through a vertical circle in the plane of the magnetic parallel* of my residence, between two and three miles north of Vienna. The arrangements were the same as before, and I directed the attention of the observer, Miss Zinkel, in the first place to the northward pole of the bar. The following diagram (fig. 22) is derived from numerous repetitions of the trial.

Fig. 22.

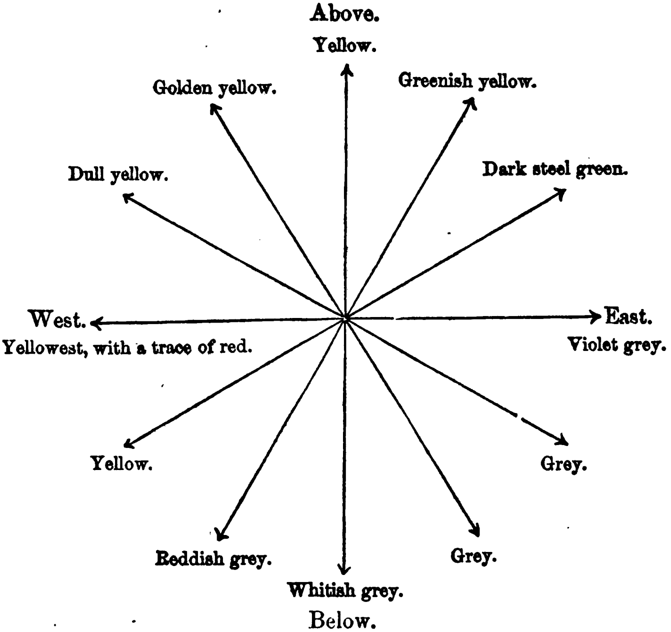


528. The southward pole, in several experiments, gave fig. 23.

529. The next person with whom this experiment was made was Wilhelmine Glaser. Her statements, after many repetitions, yielded, as a general result, grey in the east; yellow above; yellow in the west; grey again below; between east and the highest point, traces of green; between west and the lowest point, traces of red. I tried this soon after with Madame Cæcilie Bauer. The statements of this lady, so exceedingly sensitive, did not differ in any material point; grey towards the east below, and in the interval between the two; yellow toward the west, above, and in the arc between them. The slight differences of tint which were obtained in numerous repetitions of the experiment, always proved, on more accurate examination, to depend on slight variations of distance of the beholder, or on deviations in the position of the magnetic bar with regard to the direction of the magnetic parallel. Miss Sophie Pauer saw the northward pole

of the bar grey when pointing downwards, yellow towards the west, yellow also when turned upwards, and grey again towards east. Mr. Hochstetter, under the same circumstances, perceived dark vapor downwards, and towards east, upwards and towards the west lighter vapor, this being the manner in which weakly sensitive vision perceives grey and yellow.

FIG. 23.



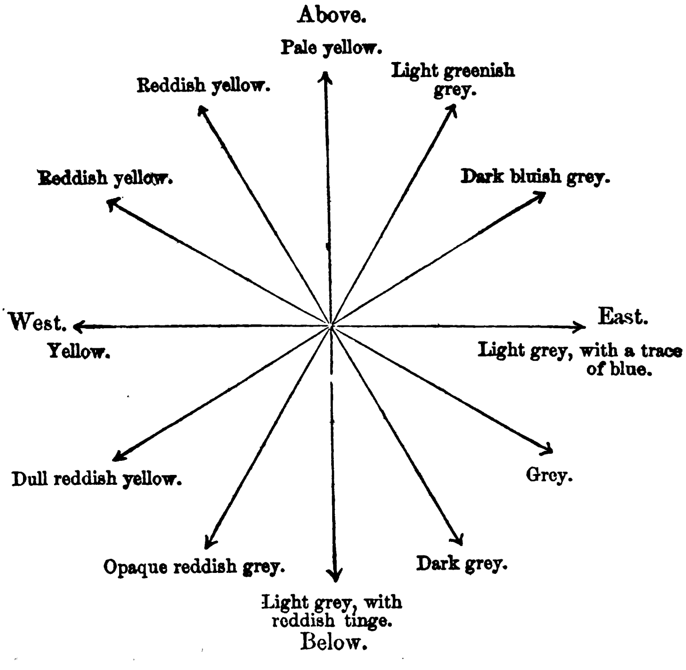
530. It is very evident that the colors of the odic flames of the two poles of the bar differ but little here in the parallels. The general result is that, in both poles, *grey declares itself the prevailing color when they are directed towards the east, and yellow when towards the west.* East, as essentially grey, corresponds, therefore, with the dip; and west, as essentially yellow, lies diametrically opposite to the dip, there in the meridian circle as here in the parallel circle. The northward pole of the bar appears rather bluish-grey in the east while its southward pole has more red intermingled, violet-grey in

the east. On the other hand, there is more of reddish-yellow at its northward pole in the west, and a purer yellow on its southward pole in the west. These slight variations of color are, however, difficult to determine accurately, and hence are only approximative.

531. To complete this set of experiments, it was requisite to pass an unmagnetic *soft iron bar* through the vertical circle in the parallel. This afforded the following circle of colors (fig. 24) with Josephine Zinkel, in the dark chamber.

532. All the statements of the colors agree tolerably closely with the result of the magnetic bar in the parallel, and this experiment merely differed in the fact that the polar flames were smaller, fainter, and duller, demanding some effort on the part of the observer to recognise them clearly.

FIG. 24.



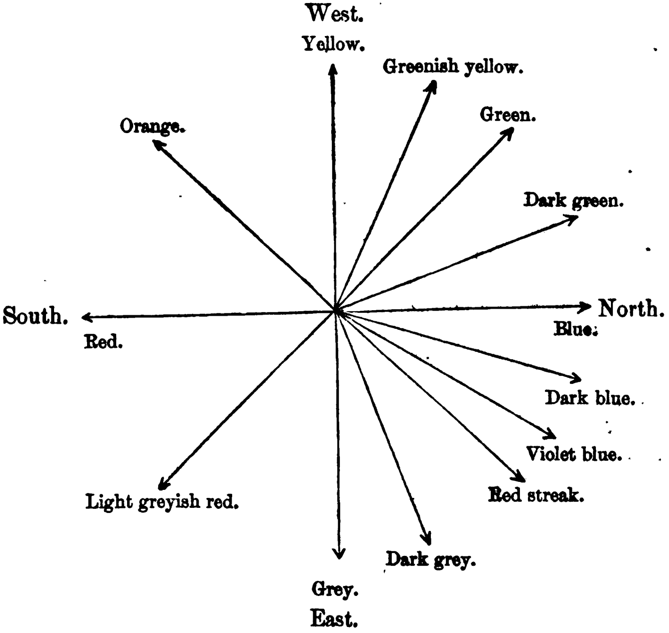
533. Yellow always displayed itself with traces of red on the west side; grey, with traces of blue, on the east side. Grey and yellow

are opposed here also, as well as the dawnings of blue, to the first shades of red.

534. *The third direction* requiring to be investigated here,—one which must serve to a certain extent for the control of the two vertical circles already examined, that in the meridian, and that in the parallel—is the *horizontal.* I give the diagram of the *northward pole* of the bar magnet used here, as is furnished by the statements of Josephine Zinkel, (Fig. 25.)

The *southward pole*, when examined in this way, behaved like the northward pole in respect to the emanations of color, with only very minute deviations; on the former red presented itself among all the colors, in the latter the blue was more predominant, in both cases strengthening and vivifying the colors on the conformable half of the circle, weakening and dulling them on the unconformable. Finally, that retardation of the development of color at the southward pole,

FIG. 25.



which has been spoken of before, (§ 514,) again presented itself in this experiment, and was noticed on the advance in the direction from east to west.

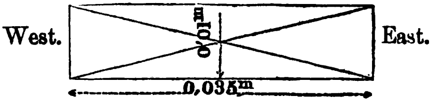
535. That agreement presented itself most satisfactorily here, which one might expect to find *in the points at which the vertical circles intersect* the horizontal *circle*, and thus, to a certain extent, form nodes. *The coincidence in the direction of north gave blue, that towards south red, east grey, and towards west yellow*, exactly and accurately as we had found at the coincidence in the same positions of the two vertical circles. They thus all serve for form, reciprocal control, and confirmation.

536. The observations are rather more difficult to make in the parallel and horizontal circles than in the vertical; this arises, in the former, principally from the circumstance that north and south, the more powerful influences upon the magnetic bar, exert continuous equally strong action upon its poles throughout the entire circle; while east and west, the far weaker odic points of the compass, alternate, and have to bear the whole weight of the conflict above and below. The length of the bar, the strength of its charge, &c., thus all exercise more influence upon those colors which are produced by lesser forces and more feebly sustained. Nevertheless, a little difference does display itself in all cases between the colors of east and west; for, in the east, the grey of the northward pole approached rather to blue, and that of the southward was slightly intermingled with violet-blue; in the west, on the other hand, the yellow of the northward pole appeared somewhat tinged with reddish; that of the southward of the fullest and most brilliant yellow, with a tint of red. The former indicates similarity between the actions of east and north, the latter, similarity between those of west and south. Thus we here arrive, by another path, at that result which we have already once met with above at § 391, namely, that *east is inclined to north, and west to south*, in odic respects generally. And since we have already seen at § 326 and § 513, that east and the downward direction, as well as west and the upward direction, harmonize with one another, we come, altogether, to the comprehensive general result that *north-east and the earth's surface* (downward direction) *form a general contrast, in odic polarity, to south-west and the heavens* (the direction upwards).

537. Among all the experiments in which the bars were turned round on a circle in this manner, in different directions, it seemed, in several cases, as if the end-flames were not exactly of the same color on different corners of one and the same pole: for when I used an unmagnetic iron bar of oblong section, namely, twenty inches long,

and about one and a third broad, only two-fifths of an inch thick, Josephine Zinkel frequently observed that the polar extremities, under the influence of terrestrial magnetism, gave lateral flames on both sides, which were not exactly alike in color. This was more observable particularly when the bar was turned round on its axis in the meridian with its broad side, that is, so that its broad face was in the plane of the parallels during the whole revolution. A cross section of the bar in this direction will make this clear. When such a bar revolved on its axis on the meridian, it exhibited almost everywhere a rather different colored side flame on its east from that on its west edge. The color on the east side had always a darker greyish tint, that on the west more of yellowish, reddish, or frequently greyish tinge. When I used a magnetic bar, the phenomenon was less strongly marked, and, if powerfully magnetic, almost imperceptible; on the other hand, it was most distinct on unmagnetic iron bars.

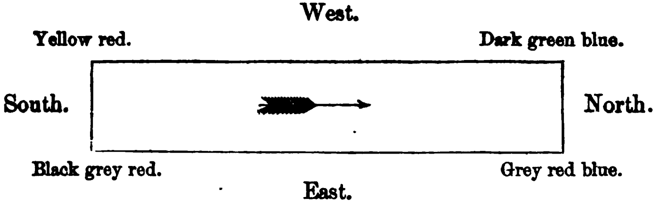
FIG. 26.



538. I met with the same in all respects in the researches with Miss Sophie Pauer. When the end of an iron bar was turned upwards, the odic flame on the westward corner alone appeared pure yellow to her in the dark; that on the eastward corner was bluish grey-yellow. The southward side of a bar lying horizontally in the meridian was almost orange in the corner next the west, but greenish red on that next the east. And I found the eastward corner of the magnetic pole directed towards the south duller in all positions, and overcast with grey, while the westward corner was brighter, clearer, and lighter. When I made the experiment on the west side with the northward pole in the parallels, the flame always appeared of greener hue on the north corner, and of more of a flame-red tinge on the south corner.

539. I was hence led to conjecture that this might be *the effect of the transverse magnetism of the earth, or an analogous odic phenomenon.* In order to trace this further out, I caused to be prepared a longish, quadrangular, flat iron plate, of full a quarter of an inch thick, twenty inches long, and six inches broad, and I brought this, supported freely in the middle, horizontally into the parallels, and into the meridian, in the dark chamber. The four corners exhibited dull odic flames in both these positions, like an unmagnetized iron bar; but a different color appeared at each corner. I showed it to Madame Bauer as it lay lengthways in the meridian. She stated that she saw flames at the corners of the following colors: —

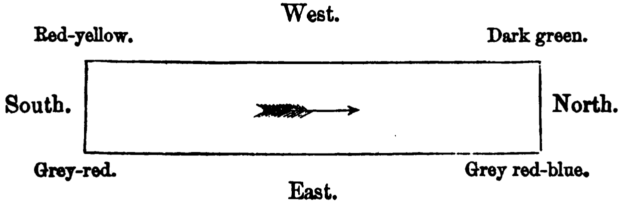
Fig. 27.



According to this, blue prevailed at both north corners, and red at both the south; but yellow was intermingled with both on the west, and grey on the east. *Thus, yellow and grey, the contrast, appeared as transverse in this experiment.* The dark green at the north-west looked almost black, and the black greyish-red at the south-east like black greenish-red.

540. I went through the same experiment with Wilhelmine Glaser. The following are the results:—

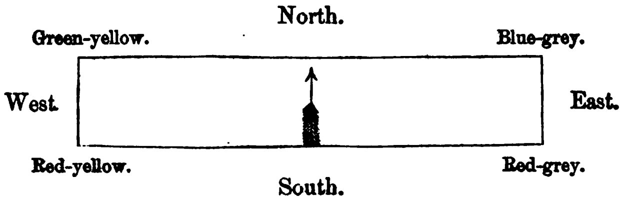
Fig. 28.



These statements agree essentially with those of Madame Bauer, and harmonize, as to the four predominant colors, with the previous observations.

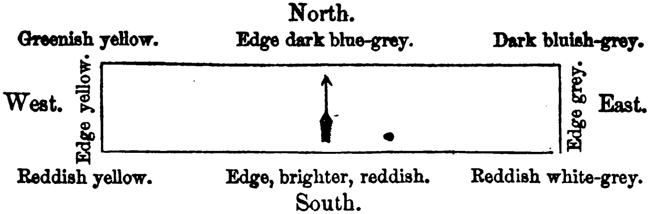
541. I showed the plate to Wilhelmine Glaser, lying lengthways in the parallel, and she saw—

Fig. 29.



542. I repeated the same experiment many times with Miss Zinkel, with every care and accuracy. The results were—

Fig. 30.



543. It was found that the colors, though dull, still decidedly followed the rule, that they appeared grey towards east, and yellow towards west. And this was not all; for they became again subdivided in the direction of each of these points of the compass: namely, in the east the flame appeared bluish-grey at the northward corner, reddish-grey on the southward; and if we subtract the grey common to both, there remains blue at the former and red at the latter; in the west, in like manner, the yellow flame appeared greenish yellow, *i. e.* with blue intermixed, at the northward corner, reddish-yellow at the southward; and, if we again subtract the like grey of both here, we find once more blue on the former and red on the latter. We thus have all four principal colors simultaneously in this longish quadrangle: on the one hand, grey and yellow at the east and west; on the other, blue and red at the north and south: consequently, when we look close into it, all four primary colors simultaneously on one and the same piece of iron, which is neither more nor less than a broad iron bar under induction by terrestrial magnetism: or, in other words, *the one polar pair of colors, blue and red, make their appearance transversely in the other pair, grey and yellow.*

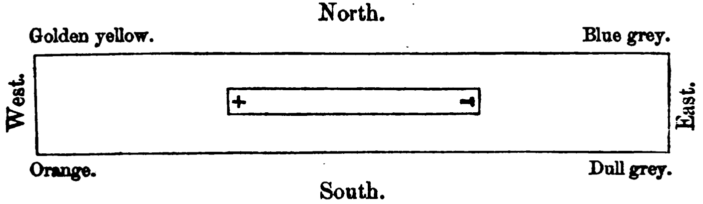
The figure shows that the edges also agreed with this: of the two longitudinal edges, one of which is directed towards the north, the other to the south, the former is, on the whole, faint greyish-blue; the latter rather lighter reddish grey, exactly corresponding to their polar directions: of the two cross edges, the one turned to the east is grey; the other turned to the west yellow, in conformity with their directions.

544. For the control of the foregoing in this last experiment with Miss Zinkel, I laid a bluntly pointed iron rod lengthways on the iron plate, and moved it forward so as to project about a hand's length beyond one of the cross edges. When so placed as to form a pro-

longation of any of the four corners, it absorbed their odic flames, and emitted them from its own point, unchanged, but strengthened by concentration. But when I moved it sideways along the cross edge, from one corner to the other, it assumed in its passage mixed colors, compounded of those of the two corner flames between which it moved; when moved in this way between greenish yellow and orange on the west side, it passed step by step through all the intermediate tints, while the colors at the corners shrank to a confused residue. The flame on the pointed bar was therefore composed of two adjacent colors, into which it became decomposed transversely when it had sufficient space.

545. In order to render these appearances stronger, I tried the effect of laying lengthways on the plate of the last figure a magnetic bar half its own length, and placed in the middle, so that its poles were at equal distances from the two ends of the plate. The intensity of light and distinctness of color were at once both increased and diminished. The northward pole, directed toward the east, converted the bluish grey of the north-east corner of the plate to blue-grey, the reddish light grey to dull grey; the southward pole, the greenish yellow to golden yellow, and the reddish yellow to orange, on the west side. Thus the northward pole strengthened the blue tints on the plate, and weakened the red; the southward pole, on the other hand, rendered the red tints more vivid and the blue fainter. Exactly similar effects were produced by laying the bar magnet the reverse way on the plate, with its northward pole to the west, and its southward to the east. Under these circumstances the blue-grey was changed to violet-grey, and the reddish light-grey into red-grey, at the east end of the plate, while on the west side the greenish-yellow gave place to dark green-yellow, and the reddish grey to dull grey-yellow; all corresponding to the effect and intermixture, on the one side of red, on the other of blue, from the magnet, upon the colors given to the iron plate by terrestrial magnetism.

Fig. 31.



546. One experiment still remained, which I was unwilling to ne-

glect, that of placing the plate vertically in the meridian with the cross edges upright, and the long edges running from north to south at the top and bottom. Thus arranged, I showed it to Josephine Zinkel in the dark, and was informed that the north edges were darker, since they were bluish; the south edges lighter, because reddish; the lower edges darker, being greyish; the upper edges lighter, because yellowish; the lower south corner darker, since it was greyish; the upper south corner lighter, because yellowish; the upper north corner darker, because verging to dark blue; the lower north corner lighter, as it approached to light grey;—all clearly corresponding closely and completely with the principles already many times laid down. I availed myself of Madame Cæcilie Bauer's aid for further confirmation of this. She, capable of seeing better, found the two northward corners to have bluish corner flames, the two southward yellowish red flames. In the case of the two former the upper was dulled with dark green, the lower with reddish grey; this because there was a slight admixture above of yellow, and below of grey, and the often-mentioned red streak: of the two latter, the upper was bright yellow, the lower dark grey-red, also because yellow had become intermixed above, and grey below. Though it was hardly requisite, I tested both the observer and the observation by turning the plate over several times, bringing the edge which was the lower in one instance to the top in the next trial. Madame Bauer assured me that nothing was changed but the position of the plate, the relative situations of the colored flames remaining unaltered. This was necessarily the case. Such a result produced through the short vertical in the long horizontal could not be other than most pleasing to me, since it confirmed in the most delightful manner the accuracy of the preceding observations.

547. When I next turned the plate thus arranged, a quarter of a circle horizontally, so that it stood in the magnetic parallel, Miss Zinkel gave me the following account:—

Above and below, as in the preceding experiment.

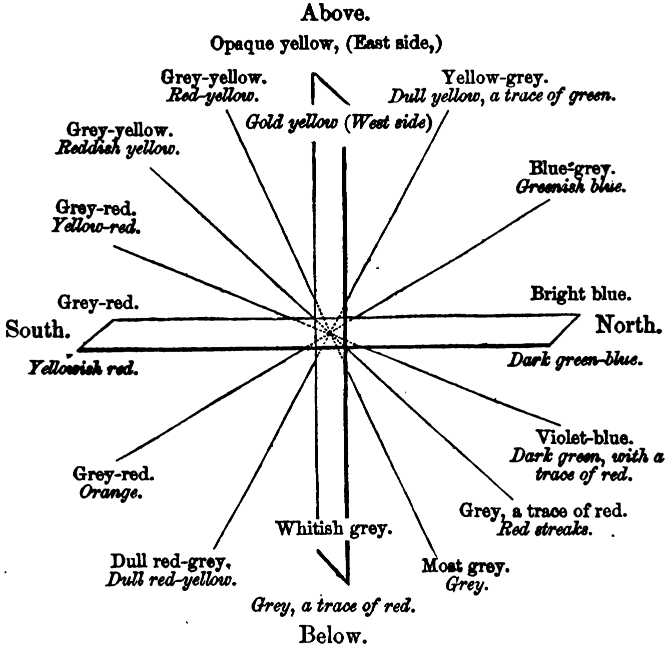
The west edges lighter, because on the yellow side.

The east edges darker, because on the grey side,—thus all four sides agreeing with the results already obtained on the bars.

During these observations the entire mass of the plates was odically incandescent, and the brightness of this increased from the shorter axis outwards towards the two cross edges (or ends.) The maximum intensity of light here was not situated at the extreme ends, but at some distance within these, as in magnetic bars. At this point, also, the down-like odic flame, which coats all the borders like a delicate fleece, was strongest and of greatest length.

548. I combined all these different observations into a single more comprehensive experiment. I had a supporting apparatus made on purpose, capable of holding a plate weighing upwards of 15 lbs., freely moving on its centre, and also arranged so as to turn round in a circle on its short axis. I laid this with the long edges on the magnetic meridian, while the cross edges ran from east to west; thus, in such a position that the plate could be turned round in a meridianal circle in the direction of its length, while the cross edges always remained in the parallel during the movement. In this way I obtained the results shown in Fig. 32.

FIG. 32.



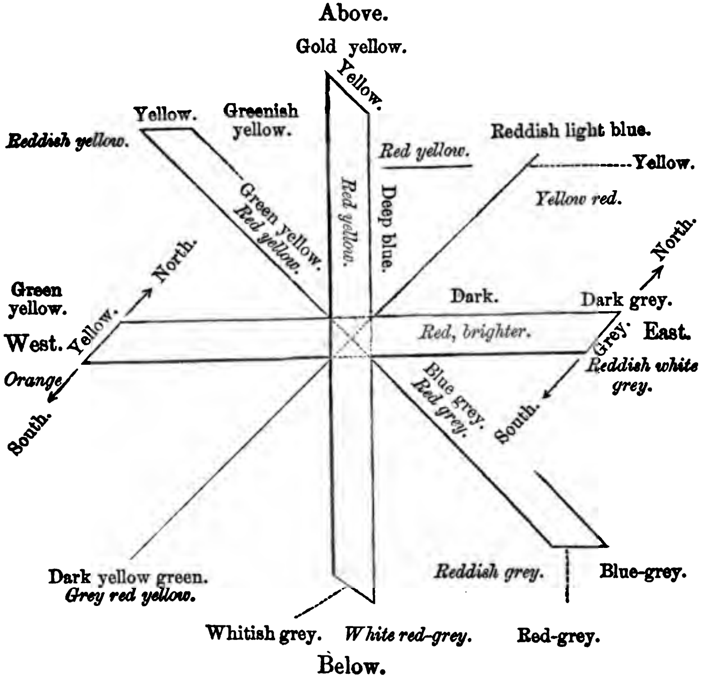
The Roman letters denote the colors of the odic flame of the eastern corners, the italics the western corners, of the short edges in each position.

549. On examination of this diagram, we find all the colors closely corresponding, *in general*, all round with the laws already discovered;

blue is found predominating in the north, red in the south, grey below, and yellow above; but when we look to the *particulars*, we see, in all the positions, the prevailing colors of any given pair of corners, somewhat modified, in obedience to a transversality, at each corner, and this always arising from an approach to the color produced by east or west side to which the corner is directed: that is to say, we see all the corners tinged grey on the east side, and all those on the west side affected by yellow; both intermixtures being manifest all round the circle.

556. I made the same experiment in the parallel, curtailing it somewhat. The following figure gives the results:—

FIG. 33.



The words in Roman letters refer to the odic flames of the northern corners, those in italics to the southern.

551. Here, again, as in all the previously-described experiments with iron bars, (§§ 513 and 536,) the *general* characters of all at the top and to the west is yellow, of all below and to the east, grey; but we find red making good its presence in a mixed tint all round on the south side, and blue upon the north side, the latter sometimes passing into dark grey, at others producing tinges of green.

552. The long edges of the plates correspond to all this throughout their whole length on both sides; nay, even their two halves become oppositely polarized, especially in the direction of the dip, —*e. g.*

Below	Blue grey. Red-grey.	Above	Green-yellow. Red-yellow.

It is impossible that these contrasts should display themselves and divide and subdivide more beautifully than they do in these numerous experiments, with the most delightful consistency. They make manifest the most inviolable constancy in the action of the all-ruling natural forces, which are in operation here, and which come clearly to light as everywhere identical throughout the modifications of the experiments.

553. And thus we have *established beyond doubt the existence of transversality in the odic phenomena*, as was long since done in magnetic by M. Prechtl's earliest investigations. The principal distinction between the two, so far as my researches have gone at present, is, as may be seen from the experiments, that *the magnetic transversality has more independence, while the odic is more dependent* upon the triple polar conditions of the earth.

554. After I had thus made out, under conditions very variously modified, that certain fixed points of the compass correspond invariably to particular odic colors, the iris itself, in which the whole of the colors always appear simultaneously toward each point of the compass, was still more puzzling. In this abstruse subject it is, indeed, out of the question at present to attempt solving enigmas, for here everything is enigmatical; but it is possible to collect facts, to arrange them according to their resemblances, and to bring the homologous temporarily into abstract groups. With this view I was now desirous of examining whether the iris, which presented itself over the poles of stronger magnets, had an independent existence, not subject to or liable to modification, by the influence of the points of the compass beyond a certain limit, or whether it might not perhaps be possible to separate its colors, and exhibit each independently. From the foregoing observations, we know that the iris always ap-

pears horizontally stratified, in such a manner that the red color is always below, the yellow in the middle, and then the blue above, over which a further streak of red occurs—succeeded, however, by grey smoke: we know, moreover, that when the iris is directed towards any of the points of the compass, a different but always a fixed and particular color becomes predominant over the rest, in size and brilliancy, in each position. I now wished to see whether, if I made the points of issue for the flaming emanations at the poles of different shapes, the iris, corresponding to the position and direction of the apparatus at the time, would be developed from all of these in one and the same way.

555. For this purpose I had a number of different iron caps made, fitting upon the pole of a large magnetic bar. They were so constructed that the lower part of all consisted of a short four-cornered ferule, which could be slipped on to the end of the pole; the upper portions were made in various shapes, just such as it seemed worth while to test the emanations of odic light with. I was thus enabled to make the pole of the magnetic bar terminate in all kinds of points. I now fixed my strongest bar-magnet in a vertical position, and exhibited it, with the various caps applied in succession upon the upwardly directed pole, to Miss Zinkel, and some months subsequently to the less sensitive Baroness von Augustin and Dr. Nied.

556. The first was *a hemisphere*, attached on the north pole. It was rather more than an inch in diameter. When the bar terminated in a rounded surface like this, Josephine Zinkel observed a dull iris, on which two colors—yellow and blue—predominated, the yellow below, the blue above; the rest of the colors were opaque and indistinct. In this case the usual form of the emanation was not much altered, and the odic flame was rather more than four inches long, as it was without the cap.

557. I took this off, and applied a cap *which was hollowed out in the centre, and a sharp rim all round.* It formed a cup, into which the hemisphere of the first cap fitted exactly, and they were consequently the reverse of each other. The raised margin alone emitted all the odic light here, and the observer saw nothing come from the cavity it bounded. The flaming rim again formed an iris, but no longer, as in the last experiment, with the colors horizontally stratified, but arranged *side by side*, and forming a horizontal wreath, which was but about two inches high. This was seen both by Josephine Zinkel and Dr. Nied.

558. When I put on a *ring-cap* like this, with the addition of a *free point* projecting from its centre, the wreath of colors remained unchanged, and no colored odic flame flowed from the central point,

but exclusively *grey smoke*. Dr. Nied detected merely a bright luminous point in the middle.

559. Substituting a cap forming a *four-sided pyramid*, consequently terminating in a single point, I obtained an elongated narrow flame, displaying an *iris*, in which the colors were again horizontally stratified, and which only differed from that of the hemisphere in having more colors, and being more drawn out, so that it rose higher.

560. With a cap having a simple *straight edge* running transversely across the pole, I again obtained an imperfect iris, with the colors horizontally stratified. Placing the edge so as to coincide with the meridian, the coloring on the northward corner was violet and blue; on the southward, red. The rest of the colors existed in a duller condition between these. When I placed the edge in the direction of the magnetic parallel, the corner on the east side exhibited grey, that on the west yellow, coloring of the odic flame; the remaining colors being irregularly intermingled along the edge between the corners.

561. With a cap having *two points* in a line, I obtained an odic flame from each. When one was on the north, the other on the south, the flame at the former was blue, at the latter red. This was stated by Dr. Nied, as well as by Baroness von Augustin. When placed east and west, Josephine Zinkel saw the former grey, the latter yellow. Turning them north-west and south-east, I obtained green and dark muddy red flames; from north-east and south-west, reddish violet and orange.

Finally, I applied a cap with *four points* arranged on a quadrangle, and so placed that each was directed to one of the four points of the compass. Differently colored odic lights now arose from all four points. Baroness von Augustin saw the flames of the east point grey, of the south point red, of the north point blue, and those of the west lightest of all and doubtful in color, sometimes light blue, at other times whitish. The statements of Dr. Nied were to the same effect, with the addition that he observed decided yellow flame at the west point. Miss Zinkel distinctly perceived a blue flame on the north point, a yellow on the west, a red on the south, and a grey on the east.

563. When I applied the caps to the magnetic bar reversed, so that the *southward pole was uppermost*, I obtained from the observations of Josephine Zinkel the same appearances in all cases, only all duller and fainter than when the northward pole was at the top.

564. I thus had the pleasure of finding the flame both of the northward and southward poles of a bar magnet, which had independently formed an iris with colors of unequal intensity, *decomposed*

(*separated*) *by the application of a four-pointed cap into their four primary colors, displayed in flames of equal size*, and in this experiment to attain with a single magnet-pole all that I had acquired previously with much more complex experiments—namely, the proof that every magnetic flame contained all the conditions necessary for the production of all the prismatic colors; and these may be called out simply and clearly in each case from the corresponding part of the compass, provided only that such an arrangement of the apparatus be hit upon that the colors can separate from each other, and each unobstructedly develope itself free from the rest. We might say, indeed, in other words, that a kind of double odic transversality is thus demonstrated in each pole of the magnet dependent upon terrestrial polarity.

565. From these results I proceeded to the examination of a *circular plate.* I had a disc of iron plate, rather more than a foot in diameter, well flattened and bored by folding the edge over an iron wire, so as to obtain a smoother and truer edge of about one-eighth of an inch thick. A little iron hook was fixed in the middle, so that it might be suspended with its surface in the horizontal position. By means of a chandelier-hook in the ceiling, I could suspend the disc freely by a silk cord, and place it at any height I pleased. I placed my strongest bar magnet upright beneath it, the northward pole upwards, and lowered the iron disc down upon it. In this manner it formed a kind of widely expanded flat cap to the pole of the magnet, or, what amounts to the same thing, an induced magnet only as long as the thickness of the flat iron plate, but with a thickness of the whole diameter of the disc.

566. I first showed the disc alone to Wilhelmine Glaser; she saw it palely incandescent, of a light grey, but could not detect colors. I then lowered it on the northward pole of the bar. She immediately beheld colored odic light upon it. A blue patch was formed in the centre; above, the surface became brighter, and the border colored all round, grey towards the east, blue to the north, yellow to the west, and red to the south, and these colors darkly blended together where they were in contact.

567. Madame Cæcilie Bauer saw the same appearance of the iron disc under the same circumstances; not, however, merely a grey surface and prismatic colors on the circumference, but with the latter running inwards a considerable portion of the distance towards the centre. When I reversed the magnetic bar, and placed the disc in contact with the southward pole, she found the arrangement of colors on the plate unchanged, but they were fainter and obscured.

568. I showed the disc, similarly arranged, with the northward

pole of the bar upwards, to Miss Sophie Pauer. She saw it immediately become incandescent throughout. The coloring of this was such as might have been expected: at the centre of the upper surface, turned away from the northward pole of the magnetic bar, a blue spot was formed; on the centre of the under face, which was in contact with the magnetic bar, a red one. She described the size of both as about half that of her hand, *i. e.* more than two inches in diameter. They merged into a yellowish ring surrounding them, the lower of which had a reddish tinge, the upper a greenish, and these were lost in grey light, which extended nearly up to the edge of the iron disc: here it was surrounded by a kind of thickened border of down-like flame rather more than half an inch thick ("as thick as her finger," she said), and again colored. Toward the east it displayed grey, toward north blue, toward west yellow, and toward south red; the north-west was green, south-west orange, south-east grey-red, and the north-east violet-blue, with a short redder piece. These colors altogether formed round the edge a continuous wreath of colors shaded into one another, and thus a kind of circular rainbow.

569. Miss Pauer saw a stream of blue light, an inch and a half high, like a common magnet flame, run out of the centre of the upper face: at its very summit it passed into sulphur-yellow, and then into grey; this was absent beneath, because the disc was applied immediately upon the magnetic bar. The entire disc was enveloped in a luminous mist, of a downy character, only distinctly visible in profile, appearing bluish above, and reddish-grey beneath. It exhibited throughout a kind of slowly undulating motion, and both on the upper and under surface flowed gently inwards from the circumference towards the centre of the disc. It projected about half an inch beyond the edge. She could disturb it by blowing, which caused it to become more luminous for the moment, but it soon returned to its original state.

570. I made a modified experiment of a similar kind with Josephine Zinkel. I connected the iron disc, suspended by its silken cord, with the poles of a zinc and silver battery of about two and a half square feet of surface, bringing two copper polar wires in contact with the centre of the disc, so that they were merely separated to the extent of the thickness of the iron plate of which the disc was made, amounting only to about the twenty-fifth of an inch; which at the same time forms a metallic connection.

The beholder immediately saw a blue luminous patch of odic incandescence, two inches in diameter, formed on the centre of the upper surface of the disc when the silver pole of the voltaic battery joined: a red patch was simultaneously produced on the under face, when the wire of the zinc end touched the iron plate. No odic flame was visible over these places; but the entire plate acquired colored odic incandescence, not merely at its borders, but over the whole of both surfaces. The colors were so distributed that blue presented itself towards north, yellow towards west, red towards south, and grey towards east, also green towards the north-west, &c. The blue and red central patches formed star-like appearances, with innumerable points, or rather radiating prolongations, which ran from the centre towards the circumference of the disc, and throughout exhibited those colors which corresponded to the points of the compass toward which they ran. The colors were so arranged upon the surface that each occupied a segment of a circle, and the whole formed a kind of circular rainbow. The edge of the disc was again enveloped in a luminous thickened border of delicate down-like odic light, such as is seen on horse-shoe magnets when the armatures are in place. This downy flame extended over the whole disc, in a thickness of about one-fifth of an inch, (" hardly as thick as a quill,") and flowed in weak undulations from the edge to the middle, where it was rather thicker. It was thick enough there to veil the brilliancy of the light of the disc like a kind of mist.

571. In order, if possible, to add the key-stone to the result of the foregoing experiments, I had a hollow globe of sheet iron made, without any projections whatever. It was rather more than a foot in diameter, and composed of two hemispheres fitted smoothly and closely, so that when one was slipped over the other, the junction could scarcely be seen. A little hole was made through this joint, in which was attached a silken cord, and the globe thereby freely suspended in the air.

Weighing all the preceding discoveries, I indulged the hope of being able, with this arrangement, to produce something which might, perhaps, in some degree, approach to an artificial aurora,—a northern and southern polar light. It appeared to me that an electro-magnet would be the fitting means of giving my globe, like the earth, two magnetic poles of equal strength, the intensity of which I could have under my control. I coiled a round iron bar of nearly an inch in diameter, with silk-covered copper wire, about one-twelfth of an inch thick, and fixed it diametrically in the globe; it was made just the length of the internal diameter, so that it remained in its place without special fastening, so long as the two halves of the globe were applied together. I placed it upright within the iron ball, and it was thus in immediate contact with the highest and lowest points of this. The two ends of the wire were brought through two little holes, lined with pieces of quill, at the top and bottom of the globe, and were connected with a Smee's battery of two and a half square feet of active silver surface. Thus arranged, the globe was shown in the dark to Professor Huss of Stockholm, Mr. Hochstetter, Baroness von Augustin, Miss Sophie Pauer, Wilhelmine Glaser, Madame Cæcilie Bauer, and Miss Zinkel; persons, therefore, undoubtedly quite healthy and vigorous.

572. Dr. Huss, the least sensitive of the number, only discerned the suspended globe during a few moments, and this at first, when the voltaic battery was in strongest action; but it now disappeared from his sight, either from loss of strength in the inducing current, or through an intermission of his sensitive powers.

573. Mr. Hochstetter saw a bright round patch arise on the top and bottom of the globe, about two inches in diameter, without visible color, and situated at the two points of the surface of the globe which corresponded to the ends of the electro-magnet touching the inside. He detected nothing else.

574. Baroness von Augustin saw the globe alone feebly luminous: when connected with the voltaic current, she saw the light increase and become enveloped in vapor. She discerned expanded clearer portions of light above and below, at the poles, which produced dull but visibly brighter patches on the ceiling and floor of the room. On the surface of the globe, from the upper pole down to the lower, she detected differences of color, weak, indeed, but distinctly blue upon the noth side, grey and dark on the east side, a reddish condition on the south side; she found the west side the lightest, but could not declare with certainty the nature of its color.

Anka Hetmanck saw the large globe in a whitish odic glow, before it was connected with a Smee's battery. When the electro-magnet was put in action, she found the globe much more luminous, and covered with broad, colored streaks from pole to pole. She saw them blue on the north side, yellow towards the west, red towards south, darker green (grey ?) towards east; she observed green on the north-west. The poles were more strongly luminous, the upper blue, and the lower red.

Madame Josephine Fenzl saw the globe become luminous, directly I had effected its connexion with the Smee's battery. She perceived the south-west side to be incomparably brighter than the north-east, yet could not distinguish colors. But both at the top and bottom of the globe she discerned flames, two or three inches broad, radiating from the polar points,—and then, to use her own expression, spreading like an open parasol over the globe, concentric with it, both above and below, but a little distance from its surface.

575. The appearances were much better developed to the eyes of

Miss Pauer. Even before the connection of the iron bar inside the globe with the voltaic battery, she discerned the form of the globe, as a ball of pale light floating in the air. When I completed the electric circuit, and thus converted the iron bar into a strong electro-magnet, the balloon became highly incandescent. Colors soon appeared in the incandescence. The beholder saw the north side become blue from above downwards, the west side yellow, the south side red, and the east side grey. She detected green between north and west, orange between west and south, violet between east and north. The light was most intense upon the west side, least upon the east. The colors merged gradually and imperceptibly into each other. But the light was developed most strongly at the top and bottom, at the parts of the outer surface corresponding to the internal points of contact of the poles of the enclosed electro-magnet, which were at the same time the poles of the globe itself: the upper pole had a blue patch, the lower a red; the former being connected with the silver pole of the battery, the latter with the zinc. Each polar patch was nearly four inches in diameter. Both passed into a yellowish color at the edge, which gradually became paler outwards and lost itself in grey. Odic flame ran from the surface at both poles, blue at the upper and red at the lower, which the observer estimated at a height of nearly four inches. She also saw a delicate grey misty envelope all over the ball, most distinctly to be discerned in profile, and rising about two-fifths of an inch above the surface; it appeared to be flowing from the equator to the poles, and was disturbed when she blew upon it. She perceived a more luminous, narrow and whitish-yellow ring running all round at the equator.

576. Madame Cæcilie Bauer perceived she globe in a faint yellow light before the bar within it was rendered magnetic. Directly the voltaic current began to pass through the wire coil, a splendid variegation of prismatic colors appeared upon the globe. The greatest intensity of light displayed itself at the poles; blue above, when the electric current was derived from the silver; red below, when it was in connection with the zinc. Both colors formed brightly luminous patches of odic incandescence, six inches in diameter, at the polar regions, dividing externally into innumerable narrow, colored meridians, which ran straight over the surface of the ball, perpendicular to the equator. On the side turned towards the north they were blue; on the west, yellow; on the south, red; and on the east, grey; and the mixed colors appeared between these in every intermediate shade. The globe was darker on the east side, lighter and with the colors more brilliant on the west. The intensity of the light of the colors diminished from the poles towards the equator, and near this they

were lost; but in their place occurred another phenomenon,—the equator itself formed a narrow, rather brighter band round the globe.

577. I was able to examine these phenomena most accurately and circumstantially through Josephine Zinkel. The period of menstruation was chosen for the trial. She saw the globe in a white light before the voltaic current was completed. When the connection was made, and the internal iron bar converted into an electro-magnet, it displayed a bright light, decorated with the most beautiful colors, which always drew expressions of admiration from the beholders. Josephine Zinkel detected all the same phenomena as her predecessors:—the pole of the globe towards the silver side of the battery, blue; that towards the zinc, red; the light most intense at the poles, forming from them great stars, with apparently innumerable points, or rather radiant thread-like prolongations, running over the globe, towards the equator, in various colors,—blue on the north, yellow on the west, red on the south, and grey on the east, and thus following the order so often observed; the whole of the east side was darker, the entire west side brighter, &c.

578. She also perceived the band which runs round the globe at the equator. She described it as a luminous streak, passing horizontally round at the greatest circumference, and thus dividing the globe into two halves, upper and lower. According to her descriptions, it is only about one-fifth of an inch broad, of pale whitish-yellow light, so that persons of a lower degree of sensitiveness cannot discern it; and hence it was not perceived at all by Mr. Hochstetter, only indistinctly by Miss Pauer, and first detected by Madame Bauer and Miss Zinkel. It is not sharply defined at the two edges, but has countless strong short teeth, like a fine comb, at right angles to the equator, and therefore pointing to the poles.

579. The luminosity of the surface of the globe, its odic incandescence, appeared to Madame Bauer continuous, but at the same time composed of innumerable clearly distinguishable filaments, which seemed to her about one-twenty-fifth of an inch thick (the size of a knitting needle,) and ran from the blue and red patches of the upper and lower poles perpendicularly towards the equatorial band. She described these filaments as not so much independent isolated streaks, as rather merely lines of greater intensity of light, alternating with fainter lines, so as to give a streaked appearance to the whole as if it were made up of threads running down from the poles. They were all of the colors corresponding to the points of the compass toward which they were directed,—thus, blue on the northward side of the globe, both above and below the equator, yellow on the west, and so on.

She saw the blue and red patches as much as six inches in diameter ("a hand's length"); that is, with a radius of three inches ("a finger's length") from the poles. Beyond this distance they became subdivided, and changed into filaments running downwards over the succeeding zones, which gave the polar patches a star-like aspect, and this the more since the different colors were of different degrees of brightness; and the lighter and darker exhibited repeated alternations, whence arose apparent projections and hollows, presenting to eye the form of a kind of star.

580. The intensity of the light of these phenomena of odic incandescence, which was greatest at the poles, decreased in regular gradation from there to the equator, so that they at length became dull in the tropical zones, and vanished wholly when they came very near to the luminous girdle.

581. The colors thus collectively forming a spherical iris around the globe were shaded off into one another in all parts; thus, blue through green into yellow, yellow through orange into red, &c. These transitions were so formed that every single filament running down as a kind of meridian over the globe, was slightly deficient in color, from there on each side of it; no two were exactly of the same color, and the difference was sufficiently marked for the observer to detect it clearly. This made the globe look as if it were composed of thousands of colored lines, which gave it such a charming appearance that Madame Bauer and Josephine Zinkel declared that they had never seen anything more beautiful.

582. The primary colors were again subdivided into several mixed tints, in their own special regions, so that collections of filaments, all differing to a certain extent from each other, formed bundles according to their resemblance. Thus there was a budlne of dark blue luminous filaments, and one of sky-blue. The green, as it became extricated from the sky-blue, formed first a bundle of blackish green, then one of grass-green threads; the yellow also, the red, and the grey, were subdivided in shades of this kind. The last formed in the middle a bundle of dark grey filaments, four-fifths of an inch broad, near the equator; on each side of this lay a bundle of whitish light grey, an inch and one-fifth to an inch and three-fifths broad. Between the violet and the grey, towards the north, appeared the often-mentioned striking phenomenon of a red streak. It was sharply defined on the side towards the dark grey, not more than one-fifth of an inch broad at the equator, (or, as she expressed it, about twice or three times as broad as the back of a knife,) and then merged rather suddenly into dark violet-blue. This remarkable red streak was particularly luminous and of a bright red,

the intensity of its light being much greater than that of the rest of the red on the south side of the globe. Thus there was *red at both sides of the spectrum, beginning and ending the series of colors*, produced on the one side out of yellow, on the other out of blue, and from this we distinctly see *the condition of the violet, generally, in the spectrum ; namely, that it is not a peculiar color, but, in reality, merely a mixture of blue with adjacent pure and independent red.* The fact that this red is so wholly merged into the blue, in the common spectrum, as only to declare itself in the violet, while in the odic spectrum it is developed independently, depends on causes which remain to be disclosed by future researches in other directions.

583. Besides the general distinction which is evident in the intensities of the light between the eastern and western surfaces of the globe, a second, not less comprehensive, was detected between the upper and lower hemispheres. The upper, with the blue pole, displayed incomparably stronger light upon its red and yellow portions, and was duller upon its blue and green ; the lower, on the other hand, when the pole was red, was more vividly luminous on its blue and grey parts, and was opaque at the red and yellow ; that is to say, that the red and yellow issued dull from the red pole, and acquired brilliancy as they approached the blue pole on the further side of the equator ; while, conversely, the blue and grey were sent off in dull threads from the star of the blue pole, but gained power and brilliancy beyond the equator, on the hemisphere of the red pole. Therefore identical colors, occurring at the poles and in the luminous streaks, displayed opposition ; unlike colors were in agreement.

584. The preceding were merely the characters of the *odic incandescence* of the globe ; we have now to examine those of the *odic flame.* A flame flowed out from each pole, perpendicularly to the surface of the globe, upwards of two inches in height and about an inch and a half thick, which *then expanded and overspread all sides of the globe parallel to its surface*, became broken up into rays and streaks, and flowed out at once into the air in filaments of odic flame, like the filaments of the odic incandescence on the globe, and parallel to them, but only to a distance of a radius of about three inches from the poles. The entire diameter of the flaming appearance over each pole was thus rather more than six inches, beyond which distance it was lost in the air. The observer compared the whole flame to a loosely-bound sheaf of corn, standing upright on the ground with the ears and stalks hanging over in curves all round, so as to lie horizontally upon one another over the band. The streaks of flame were not steady, but flickered and scintillated constantly backwards and forwards, becoming shorter and longer, and shooting out in rays like

the electric flash on the positive electrified conductor. *The resemblance of this phenomenon to the polar light of the earth* is too manifest to any one who may take the trouble to read these lines. The iron sphere became in this way a *terrelle*, analogous to Barlow's.

585. A second phenomenon connected with the odic flame of the globe is a *thin envelope of luminous vapor*, a kind of delicate *photosphere*, or atmosphere of light, surrounding it. This consists of an opaque veil of light, not in contact with the surface, but at a little distance from it, and floating freely in the air above it, like a spherical shell. The distance from the surface amounts to about two-fifths of an inch (the thickness of the little finger was the expression,) and the misty envelope itself was only about one-twelfth of an inch thick. This luminous envelope is probably similar to that which this observer and many others have described as existing over a ball or an electrified conductor, which I shall give an account of in a future treatise. It differs, however, from this in the circumstance, that while the latter completely envelopes the electrified ball, our *terrelle* is principally clothed with it when the blue and red streaks of light prevail, while over the yellow and grey regions it becomes fainter, and in one part almost entirely vanishes. This envelope, therefore, follows more especially the direction of the terrestrial meridian in which the iron globe is placed, abiding in the northern and southern directions, and retreating from the east and west. The density of the shell of vapor was not altogether inconsiderable there, for it was sufficient to obscure the filaments of light beneath it perceptibly, and to affect the distinctness of their outlines.

586. *Odic smoke* rose in abundance from the globe above its polar flames. From the upper blue flame it ascended vertically to the ceiling, enveloping the silken cord by which the globe was suspended. Both this cord and a small weight that was fastened to it some distance up, became luminous in a golden yellow color. On the ceiling above it formed a large light patch more than twenty-six inches (an ell, she said) in diameter, so light that she could dimly discern the painting on the ceiling; it then turned outwards and extended over it visibly for a distance of about a yard. The silken cord was also visible in faint odic incandescence for a certain distance along the ceiling.

587. Six months afterwards I had another much larger globe made of sheet iron. This was about twenty-one inches in diameter; the iron bar placed inside, one inch thick, with a triple coil of covered copper wire one-eighth of an inch thick. The zinc and silver battery connected with it was powerful enough to make this wire hot. The globe was observed by Baroness von Augustin and Miss Wilhelmine

Glaser. The former saw the colored meridians running from pole to pole, as already described, (§ 574,) in speaking of the odic incandescence of the globe. In addition to these, she discerned short luminous columns flowing out as a kind of vapor from both poles, reddish at the positive and blue at the negative. The columns or stalks of light, as she called them, spread out above and turned over. She compared them with the form of a palm-tree, when the leaves spread out in all directions at right angles to the stem. Wilhelmine Glaser perceived the globe to be streaked all over, from top to bottom, grey on the east, red on the south, yellow on the west, and blue on the north; also green at the north-west, and so on. The colored streaks were about of a hand's breadth where they passed over the equator, and were separated from each other by opaque, indistinct, transitional streaks of the same breadth, in which the colors were blended together. She saw a mass of light above, which she also described as resembling a tree with the stem ascending from the pole, and the branches, separating each other, and overhanging on all sides. This is the very same condition as that which Josephine Zinkel compared to an overhanging wheat-sheaf, and also to a tassel turned the wrong way upwards. She perceived a similar appearance, of a red color, below, but this was less distinct. Anka Hetmanck also saw streams of light issuing from the top and bottom; that is, the two poles of the globe, spreading out on all sides like the branches of a tree. Josephine Zinkel observed everything the same on the large as on the small globe, with the exception of the girdle around the equator, and the filaments into which each color was subdivided on the surface of the smaller globe. The larger globe probably possessed a somewhat less intense development of the odic force; hence these variations.

588. We see the statements of Josephine Zinkel controlled in all essential particulars by those of Madame Bauer; of which, indeed, they are merely an extended and detailed amplification. The statements of Madame Bauer, again, are confirmed by those of Miss Sophie Pauer and Wilhelmine Glaser, and the observations of Baroness von Augustin and Mr. Hochstetter form a basis for these. All these sensitives report the perceptions merely in greater detail in proportion to the higher degree of their power of seeing odic phenomena. Madame Bauer, it is true, is more sensitive than Miss Zinkel in her ordinary condition; but the last experiments with the latter were made during the presence of the catamenia, at which periods she not only equalled Madame Bauer, but even somnambulists such as Misses Reichel, Atzmannsdorfer, &c., in sensitiveness of vision. The reason why Madame Bauer did not report some of the characters of the globe, and described others less perfectly than was done by Josephine

Zinkel in the subsequent researches, is most probably to be found in the short time which the former could stay with me, and, on the other hand, in the tranquillity and leisure with which I was enabled to experiment with the latter, to repeat the investigations on different days, and carry them out in detail.

589. Such explanations, indeed, are unnecessary to any one who has attentively marked the course of these experiments; the researches, continued now for more than three years, demonstrate on every page that throughout the whole of some sixty persons with whom I have pursued my inquiries, the same threads of physical laws run on, and that every succeeding ramification affords but new testimony to their accuracy, and new evidence of the consistency of their connection. Thus, in the most recent researches, we have seen a yellow odic flame flow out from the point of a vertical bar of unmagnetized iron (§ 525), but from a magnetic bar (§ 517) an iris with horizontally stratified colors, exhibiting red a second time over the violet. When the upper end of a vertical magnetic bar had the form of a horizontal line (§ 560), it afforded an iris with the colors side by side. Bars (§ 517) displayed colored odic flames at both ends, certain predominant colors always in contrast, those of one contrast in the meridian, those of the other in the parallels. Quadrangular iron surfaces (§ 539 *et seq.*) exhibited both the contrasts of colors at once, predominant colors being situated at the four corners. It was even possible to separate and isolate the colors of the odic spectrum on one single pole; a cap with two points placed on the pole (§ 561) gave both the contrasts of odic colors,—one when placed on the line of the meridian, the other when arranged in the parallels, as a bar does at its two ends when placed in the same lines; and a four-pointed summit (§ 562) actually afforded all four primary colors at once; it displayed to the eye, simultaneously, a double, crossing, transversality, most beautifully defined. A circular surface (§ 565) acquired in the horizontal position all the primary colors of the pole at once, producing at the same time the intermediate mixed shades. Finally, proceeding from the circle to the globe (§ 571 *et seq.*), we arrive at a combination of all these phenomena, each independently marked, but all collected on one focus of activity, the surface of the sphere, on which they might be seen in all their mutual relations in one view. The arrangement by which these demonstrations were effected was different in different cases; sometimes I made use of the terrestrial magnetism, sometimes of a magnetic steel bar, or of an electro-magnet, but all came to one and the same ultimate principle, as will be readily understood. In this section we have seen, in innumerable modifications, that, (*en résumé*,)

590. *a.* The light which the magnet visibly emits in the dark, is seen, by the sensitive, of different colors at different distances; but always of the same color to each particular eye at a fixed distance.

b. This light not only appears in a variety of outward forms, but assumes every known kind of color.

c. These kinds include all the primitive colors, all their intermediate shades, and white and black mixed in every gradation of grey.

d. In many cases they appear singly to the sensitive eye; in such instances they are grey at both poles, or blue at the southward, and red at the southward pole.

e. Most frequently, however, and always when of a certain degree of intensity, several occur together; they often all appear at once.

f. When they occur together, and arrange themselves freely, they take the relative positions of the colors of the rainbow.

g. The red end of the iris is then below, the blue above.

h. Above the blue, the intermediate shade violet being interposed, a pure red appears a second time, so that the odic spectrum, which commences with red, running through orange, yellow, green, blue, and violet-blue, terminates in red again.

i. The phenomena of colored light are produced according to the same laws by the magnetism of steel, electro-magnetism, and terrestrial magnetism.

k. The last, since it is motionless relatively to us, impresses certain rules upon them, causing different results at each particular point of the earth's surface.

l. Terrestrial magnetism produces them in unmagnetized iron bars.

m. In all the observed cases, and probably universally, the phenomena of odic light consist of an iris, except, perhaps, in certain directions in which they appear grey.

n. As a rule, one, or more rarely two colors predominate in size and intensity in this iris. In many instances only this prevailing color is perceived by the sensitive; the others, being fainter, escape them.

o. In general, they are grey when directed towards the point of the magnetic dip; blue towards the north, yellow above, red towards the south; they also appear grey in the east, and yellow in the west. Mixed colors, such as green, orange, violet-blue, &c., lie between them. This holds good in all its details in the meridianal circle, in the horizontal, and in that of the parallels.

p. If the magnetism of steel or electro-magnetism come into conflict with terrestrial magnetism, through unconformable position, the colors of the odic light are weakened and changed. In the conformable position they are strengthened and rendered more vivid. Intermediate positions afford intermediate tints.

q. Crystallod, Biod, and Od, from any other source, act upon the odic light of another body in the same way as terrestrial magnetism, when brought into conflict with it.

r. A magnetic bar, turned round on its axis, and flaming at both ends, does not exhibit at its poles, either in the vertical circle, in the meridian, or in the parallels, in the horizontal circle, or in any position whatever, odic flames displaying complementary colors, although they stand in polar opposition.

s. But the colors of the upper half of the circle display more brilliant light than those of the lower. All colors produced by the northward pole of a magnetic bar are more brilliant in the half of the circle turned towards the north, and duller on that turned to the south ; the converse holds, with regard to the intensity of the light, in the colors produced by the southward pole.

t. These colored odic flames may be conveyed from magnets on to other conductors of Od.

u. Magnetic bars, terminating in several points, have the colors distributed among these, so that each bears a different color, corresponding to its point of the compass, and the iris of every flame may be decomposed, or subdivided into its elementary colors.

v. A four-cornered iron plate in this manner shows both magnetism and Od not merely as longitudinal, but transverse, so as to present two directions, at right angles to each other.

w. A circular surface of iron, and still better and more perfectly, an iron sphere with a strong electro-magnet passing through it, exhibits all these appearances combined, and possesses, in addition, a number of new ones, so as finally to acquire every resemblance to the terrestrial globe with the polar lights playing over it.

x. The odic nature of the positively magnetic north pole of the earth, the odic nature of the east and of the earth's surface (the *nadir*, or that *below*, in all cases) bear a certain character of agreement, in which they stand in opposition to the negatively magnetic south pole of the earth, the west and the heavens (the *zenith*, or that above).

ODIC LIGHT, IN THE MORE RESTRICTED SENSE OF THE WORD.

591. It is scarcely necessary to explain that *odic light* must be carefully *distinguished* from odic incandescence, flames, streaks, sparks, and smoke, and that the latter are to be regarded as sources of the

former. This is involved in the circumstance that we see all these phenomena; for, from the structure of our eyes we are only capable of seeing that which emits light; that is, whenever we see anything, that something is emitting luminous rays. I have already clearly expressed myself on this subject in § 20 of the first Treatise. The statement of Miss Reichel there reported, that she saw the odic flame of the nine-layer horse-shoe magnet diffuse light for twenty inches round over the tube, as well as that of Miss Sturmann at § 55, I have found confirmed, in the meantime, by numerous fresh observers. I will only name some of the more important here. The blind joiner, Bollmann, discerned that the flame of the nine-layer magnet diffused a brightness to the distance of an arm's length around, which he compared to a large light cloud. Josephine Zinkel saw a magnetic bar throw light upon the armature lying near it; when she placed her finger and other objects between them, she saw the light intercepted and shadows thrown on the corresponding parts of the armature; moreover, she saw a light issue from two horse-shoes which I brought near together upon a table (§ 405 *c*), rendering the surface of the table visible for twelve to sixteen inches. Miss Atzmannsdorfer saw not merely the immediate vicinity, but the whole room, lighted to a certain degree by the five or six feet high flame of the nine-layer magnet, so that she could distinguish all the larger objects, as in twilight. I have already mentioned, on many occasions, the fact of several other sensitives seeing the ceiling of the room so much illuminated by the odic flames and odic smoke of magnets, that they could distinguish the lines of the painting on it; in particular, Dr. Nied and Mr. Delhez saw a lighted space, as large as a common round table, upon the ceiling of the darkened chamber, over the nine-layer magnet four or five yards distant below. Professor Endlicher and Baroness von Augustin saw the ceiling illuminated over the same large compound magnet, and to a still greater extent over a strong electro-magnet. Baroness von Augustin saw the larger *terrelle* throw large lights, more than forty inches in diameter, both on the ceiling and the floor. Mr. Hochstetter, standing in front of a nine-layer magnet in the electrical atmosphere, saw the table illuminated to the diameter of forty inches by its flame; and he discerned a round spot on the ceiling directly over it. Both the *terrelles* afforded a remarkable case, and one which is the more worthy of notice, that it stands isolated, without connection with any of my other observations. Besides throwing a patch of light some twenty-six inches in diameter upon the ceiling, sufficiently bright to allow the painting to be made out, the globes also cast a separate, half-moon-shaped patch of light laterally to the north-east, or perhaps the north part of the ceiling, and this movable backwards and forwards with the globe. This phenomenon is one which must lead to important results when followed out.

592. On one occasion, when Josephine Zinkel was in the dark chamber, she noticed a little spot of light, which she detected at some height on the opposite side of the room. We went towards it to seek the cause, and, on coming near, it was found that the spot of light was on the ceiling, and that a slender ray of light was running upwards to it. On searching, we found a magnetic bar twenty inches long, and about one inch square, standing with its southward pole upwards on a support. From this the streak of light ran up vertically, and produced a spot of light upon the ceiling, the size of which the observer compared to that of the bottom of a common wine-glass. Whenever the magnetic bar was moved, the bright spot on the roof moved with it; when I interposed my hand, it immediately disappeared. This demonstrates the remarkable fact that the cause which produced the odic light *remained closely aggregated, at a distance of more than four yards, without having suffered dispersion*, for the cross section of the magnetic bar and the spot of light on the ceiling were pretty nearly equal in size.

593. I turned a seven-layer horse-shoe magnet towards one of the solid walls of the dark chamber, at the short distance of two feet. Two spots were formed, side by side, one dullish, corresponding to the northward pole, the other very luminous and reddish, opposite the southward pole. According to Miss Zinkel's statement, both the spots were about the size of an egg. I must reserve the explanation of this interesting phenomenon for a future treatise; here I confine myself simply to the fact, that the flaming phenomena of horse-shoe magnets throw light, which does not suffer dispersion, on the side walls also of rooms.

594. Josephine Zinkel observed a still further stage of these phenomena: when I had coiled a copper wire one-twelfth of an inch thick round the northward pole of the nine-layer magnet, she saw a beautiful stream of odic flame, eight inches long, issue from the outer end of the wire, so exceedingly luminous that it lighted up the floor at a distance of more than a yard. The experiments immediately following will confirm still more the contents of this paragraph.

CONCENTRATION OF THE ODIC LIGHT.

595. I have since repeated on many sensitives the experiment described at § 18 of the first Treatise, in which I endeavored to concentrate the magnetic light by means of a glass lens, in the presence

of Miss Reichel. For this purpose I obtained from Paris a large lens a foot in diameter, with a focal length of about eleven inches. I had this heavy glass so mounted as to be easily movable in any direction. I laid down a large nine-layer horse-shoe magnet at a distance of forty inches from the lens, with both poles directed towards it. I could not well place the magnet further off, since I should then have lost too much of the always sparing amount of light; on the other hand, the flame of the magnet was itself ten or twelve inches broad, and thus I could at all events reckon, in spite of the proximity of the source, upon a sufficient quantity of parallel rays of light falling upon the lens to admit of their being concentrated into one principal focus. This arrangement was submitted in the dark room, at different times, to the sickly Miss Atzmannsdorfer, Madame Kienesberger, Miss Dorfer, and Friedrich Weidlich, to the healthy Messrs. Kotschy and Tirka, the joiner Klaiber, and the blind Bollmann; also to Miss Zinkel and Wilhelmine Glaser. Even the blind man could distinguish light at these different points; and when I made him feel his way to them, he placed his hands, successively, on the magnet, which he stated to have pale yellowish light; on the glass lens, which were reddish; and, lastly, on the screen, which he stated to be white, and the smallest but strongest of the lights. With a distance of from twelve to sixteen inches between the screen and the lens, all the other persons perceived a round spot of light upon the former from four-fifths, one and three-fifths, to more than three inches in diameter; the most accurate observers stated twelve inches to be the distance, between the lens and screen, at which the focus appeared smallest and brightest; in particular, Madame Kienesberger, Wilhelmine Glaser, and Josephine Zinkel. At the same time they all saw the glass lens in reddish odic incandescence, just as they saw the bell of the air-pump when the magnet was beneath it; but the light in the focus was white. Mr. Kotschy and Miss Atzmannsdorfer called my attention especially to a distinct cone of light which they saw with its base resting against the lens, the apex converging into the focus. When I moved the screen a little nearer or farther off the lens, in the presence of Josephine Zinkel and Wilhelmine Glaser, they saw the size of the spot of light upon the former increase every time. Madame Kienesberger made the same statement, with the addition that every time I removed the screen a little further off, the enlarged image assumed the *prismatic colors*, arranged in the following order: a dark red spot in the middle, around this a yellow ring, which was encompassed by a broader ring of blue. Wilhelmine Glaser, whom I allowed to move the screen backwards and forwards herself, in the dark, until she hit the focus, sometimes saw a blue ring appear outside the yellow circle, sometimes a blue spot arose in the middle of it. Josephine Zinkel gave me similar accounts many times. Thus, an iris had begun to develope itself here also. Although I had entertained some hope of being able to observe the phenomena myself when the light was concentrated, I could not, unfortunately, perceive the slightest trace. I laid two magnets, a nine-fold and a seven-fold, one upon the other, in the presence of Baroness von Augustin, with the view of rendering the effects of the light more powerful. She saw upon the screen a round patch of light, about six inches in diameter. She detected in the middle of this an inner round place, about an inch in diameter, much more strongly illuminated. This was evidently the focus of the parallel rays that fell upon the lens. The Baroness was kind enough to make an oil-painting representing this phenomenon as she saw it, thus making it quite clear to every one. I went through the same experiments, pretty nearly in the same way, with two superimposed magnets, in the presence of Madame Josephine Fenzl. As she about equals Baroness von Augustin in the degree of sensitiveness, it was interesting to obtain from them both exactly similar descriptions of the size and intensity of the luminous appearances on the screen. I tested the sensitive beholders by making various alterations in the dark, which they could neither perceive nor understand; I moved the screen backwards, forwards, and sideways, pushed the magnet to the right or to the left, and turned the lens upwards and downwards; in every case they all told me of alterations in the position of the focal image, corresponding to those it should suffer according to the known laws of dioptrics, and which it would be quite superfluous to enumerate here. The foregoing confirms the experiment with Miss Reichel, formerly made known by the testimony of four sick and eight healthy new witnesses, and I can only desire that other conscientious observers will soon repeat them, and establish the facts I have recorded.*

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* Towards the close of the proceedings of the so-called Committee of the Vienna Physicians, a division arose in its own bosom. Some of them, particularly Drs. Wotzel and Steiner, felt the uncertainty of the plan of investigation, and the want of credible foundation for the conclusions drawn. The latter took the precaution, before the publication of the reports of the physicians, to inquire of some of the sensitive persons whom I had experimented with as to the methods I pursued, and their results. As he received from the most trustworthy persons nothing but confirmation of the experience of sensations of feeling and sight exactly such as I had described in my publications, he expressed a desire to witness some of my experiments for his own conviction. Perfectly ready to accede to this, I invited him to a trial with a new sensitive person, whom I had never seen before. Dr. Steiner could not but be convinced, from his own inspection, of the accuracy with which my investigations were made; and he necessarily felt a misgiving that the superficial labors of the committee might be refuted with proofs by me, and the

596. Another observation, made by Professor Endlicher, also refers here. Commonly wearing spectacles, he kept them on in the dark chamber. As I was showing him magnets, which he did not see so distinctly as I expected from what I knew of the degree of his sensitiveness, it struck Dr. Fenzl, who was present, that the spectacles might interfere. Professor Endlicher removed them. He immediately saw the emanations of light from the magnets very distinctly, and just as I had presupposed from his sensitive excitability. The glasses had thus certainly reflected one portion of the light, and absorbed another, and what remained was so small a residuum that there was scarcely enough to be perceived even faintly by the sensitive eye, while the collective amount given out by the magnet was very clearly visible, and displayed a flame four inches long.

597. When I had thus established that the magnetic light penetrates glass, and, in its passage, undergoes absorption, reflection, and refraction, uniform with those of common light, it remained to test the first two by reflecting surfaces, and compare their behavior with that of ordinary light. It was quite possible that odic light might be absorbed, and be incapable of producing catoptric phenomena, in so far, at least, that the Od, from which it is derived, is readily absorbed by all bodies.

598. I made use of a common quicksilvered mirror in my experiments in this direction. I placed one in front of Miss Atzmannsdorfer's bed, and opposite to it, in a suitable position, a nine-layer magnet,

participators in the affair be sooner or later exposed. This determined him to address the meeting of the Medical Society on the 16th of November, 1846, urgently opposing the publication of the report of the committee against Miss Reichel, and indirectly against me. In his address, which appeared publicly in the printed report of that day's sitting, he says, among other things, "from *such results*" (as those obtained by the labors of the committee) no absolute proofs against the matter could be drawn. For his own part, he was compelled to declare that opportunity had been afforded him of seeing Baron von Reichenbach experiment with persons for whose honor, truthfulness, and impartiality, he could vouch as for his own, and that he had been astonished at the agreement of the statements of these with the assertions contained in Baron von Reichenbach's pamphlets. And other persons, well known to him, and of the greatest respectability, had assured him that they had found Reichenbach's experiments confirmed in their own persons." He therefore gave it as his opinion that the report of the committee would only compromise the Society, and that it would be much better not to publish it at all, or at all events only within the circle of their own members, which limits, as a private matter, it should not be allowed to pass. A violent discussion arose on the subject on the general meeting of the Society, and it was decided by a large majority that the report of the committee *should not be published* in the name of the Society. How far this resolution was carried out by the officers of the Society, is seen on looking at the title-page of the Part of the Journal in which the report appeared.—*Author's Note.*

standing with its poles upright. She saw in the mirror the image of the odic incandescence of the metal, but she did not discern odic flame, not even a trace, during careful search on different dark nights. I repeated the same experiment a year after with Miss Zinkel; she also saw the odic incandescence of the horse-shoe reflected from the mirror, but could not distinguish a flame, or any other kind of emanation, from the magnet. The light of the flame of the nine-layer magnet was therefore so weak that after the usual absorption by the glass there did not remain enough for reflexion to be detected by these two sensitives in their conditions at those periods.

599. I had given up hope of finding these emanations detected in the rays reflected from a mirror, when, in an experiment for confirmation, made some time after with Wilhelmine Glaser, she not only corroborated the statements of seeing the reflection of the odic incandescence, but declared she saw a faint appearance of the flame in the mirror; weak, it is true, but yet a real representation. I then repeated the experiment with Josephine Zinkel during the catamenia. She also now saw a reflexion of the magnetic flames very distinctly, although unable to detect it before. In the last place, I tested it with the very sensitive eyes of Madame Cæcilie Bauer. She immediately saw a number of incandescent objects in the mirror with tolerable clearness. She perceived the odic flame of magnets sufficiently well to distinguish pretty accurately between the blue and red of the two poles. But she declared that the image in the mirror was far duller and fainter than the direct light of the flame. In the original flames of the two poles of a seven-layer horse-shoe, she could detect even a portion of an iris, yellow and violet, as well as some smoke; they were certainly weak, but in the reflected image they had vanished altogether from her eyes.

600. In particular cases, odic light is also capable of penetrating *semi-transparent bodies.* This is shown by the fact that it is still detected in the dark *through closed eyelids.* I owe this observation to Madame Josephine Fenzl, who first observed that she could to a certain extent perceive the odic luminosity in the dark chamber, even when she had closed her eyes. I repeated the experiment with Madame Cæcilie Bauer and Misses Zinkel and Atzmannsdorfer. They all perceived odic flame and incandescence with closed eyes. It is true they lost the form and shape of objects, but they could detect the presence of any body which emitted odic light, without doubt, when it was brought near them. They could point out the direction from which the brightness came, could state whether it was derived from one or several detached points, and they perceived distinctly odic

incandescence as well as flame; not, indeed, distinguishing the two, but recognising the character of emitting light common to both.

601. The eyelid, however, is very transparent. When a person is in the dark, with the eyes closed, and a lighted candle is brought near, the approach of the light is instantly and very strongly perceived; indeed, this transparency is so great, that no one can bear to keep even the closed eyes turned towards the brightly shining sun. *The odic light, then, weak as it is, is still strong enough to penetrate through closed eyelids, and become visible to the sensitive.* We shall hereafter find that this circumstance, by itself insignificant, becomes of some importance when it comes to be applied to the elucidation of other rather striking phenomena of sensitiveness.

THE NORTHERN LIGHT.

602. And now I must beg the reader to cast a retrospective glance back to § 21 of the first of these treatises; thus to the very beginning of my labors. I already expressed the opinion there, at a time when I was in possession of far less experience of the odic light, that it was the same thing which, on a large scale, constitutes the northern light, and polar light generally. In the long interval that has elapsed, which I have uninterruptedly devoted to the study of this subject, this opinion has not merely remained unshaken, but has had confirmation and support forced upon it on every side. The observations which I have made on the behavior of the odic light under the air-pump, its development of colors, the motions which the odic light may be made to exhibit at will, the discovery that it is visible to great numbers of perfectly healthy persons,—these things are all weighty considerations, not, in any case, opposed to my original view, but evidently new and powerful supports to it. Sir Humphry Davy's idea, that the northern light is not so much a magnetic as an electrical phenomenon, a tranquil and slow neutralization of the electricity of the air at great heights, when the air, much rarefied, taking the place of the rapid stormy discharges of the thunderstorms occurring at less altitude in our latitudes, is mainly opposed by the following facts: that in the temperate zone also, as well as in the arctic, the meteoric changes of rain and snow proceed without thunderstorms through the whole winter, and yet no phenomenon resembling the polar light is produced by an accumulation of the electricity of the air; that from the numerous recorded observations made since Davy's time, it is found that the polar lights do not appear more frequently in winter than in summer; that so universal an accumulation of electricity in the atmosphere as would be necessary to half fill often

one quarter of the globe with electric light, through half the night, is, from the rest of our experience of the laws of electricity, inconceivable under the constant movement existing in the air; lastly, that there is no apparent reason why such an accumulation of electrified air, supposing it to exist, should occur in preference at the magnetic poles. Davy's hypothesis was favorably received as an ingenious idea, but has not proved to have foundation in the settled laws of science: it does not give sufficient account of the relations of cause and effect. But now that we know from our more recent researches *that flaming light exists over the poles of the magnet, which are larger than magnets themselves;* since we have seen that *this flaming appearance occurs mobile, undulating, frequently serpentine, like rolls of riband blown about by the wind;* often varying in size from larger to smaller, shooting out rays, scintillating, variegated in color, and also in the form of *vapor;* since we perceive it to be capable of being made to *flare backwards and forwards by our breath;*—finally, when we now hear, that it increases in vast proportions in size, as well as intensity and brilliancy of light, *in rarified air;* when we see how the play of *color of the rainbow* follows it every step, &c.,—there is actually scarcely a single essential character of distinction between magnetic odic light and the northern light left, for it would be from the difference of intensity that the latter is visible to ordinary eyes, while the former can only be seen by the sensitive. The undulations and serpentine movements sometimes exhibited by the northern light are thus explained simply by the motion of the wind, which drives the odic flames about over one another, in the more or less rarified higher regions of the atmosphere, as our breath does the odic flame over the poles of magnets; the constant change by increase and decrease of size, correspond exactly with the unsteadiness which the magnitude of the flame exhibits in our laboratories; and the vast flames at great and undetermined altitudes which have been observed by particular travellers above the *cirrus* or most elevated clouds (*Lämmerwolken*), agree most beautifully with our observations under the air-pump (§ 481), where the odic light increased remarkably in size and intensity of light under the diminished pressure of half an atmosphere. And the equally well-attested observations of other travellers, who have observed abundance of auroras with the most scrupulous attention in the polar regions, where the altitudes appear to be very much less, and the light often in the form of luminous clouds, harmonize perfectly with the nature of the magnetic light. In the foregoing researches, we have frequently met with the odic luminous vapor, flame-like smoke, or whatever we may please to call this appearance. It also increased under the air-pump. This produces the luminous cloud-like phenomena, always ascending from below and completing the parallel between odic light and the northern light or aurora. The vaporous, cloud-like, luminous nature of the polar lights has been accounted for by supposing the appearance to be produced by illuminated clouds. These may have occurred in many cases; but it is clear, from my investigations, that there is no necessity for such clouds, and that accumulations of Od develope independently in the air smoke-like, that is, cloud-like luminous appearances, which in some of my experiments illuminated the whole room up to the ceiling. The higher the odic emanations of the terrestrial magnetic poles ascend in or above the atmosphere, the larger, more luminous, and brilliant must be the emissions that unfold themselves, from the same cause which makes them increase so greatly under the air-pump, even with moderate rarefaction of the air. As healthy persons who are not sensitive perceive nothing of the motions of magnetism and Od, it is easy to explain why travellers could perceive no unusual sensations, even at the very poles of the earth. And the often-mentioned observation, that the aurora has been seen to the south in high latitudes, is no longer puzzling; the odic light, wherever developed, shines from its localities with equal strength in every direction.

603. Finally, looking at the rich combination of odic luminous phenomena displayed by the iron globe (§ 571, *et seq.*), we recognise in it a kind of *terrelle*, or miniature earth, *exhibiting artificial northern and southern lights on a small scale.* As the earth is a large magnet, my globe, by reason of the electro-magnet passing through its axis, is a magnet of the same form in miniature. *Their poles emit, in the former on a great scale, in the latter on a small, delicate light visible only in the darkness of night. High above both poles it turns over and flows on all sides towards the tropical zones,* broken up into filaments and rays on the great terrestrial globe as on the little *terrellé;* iridescent with all the prismatic colors, on the former as upon the latter. If we may venture to add, that the difference of the intensity of light in the two cases may probably be proportionate, in some degree, to the difference of size of the two globes, in which the mass, of course, increases as the cube of the diameter, while the surface only enlarges as the square of the same, whereby, consequently, the odic light, emitted by the mass but only poured over the surface, must become more concentrated on the earth, in a degree corresponding to this difference of size, than at the poles of the *terrelle,*—the greater luminosity of the aurora, which surpasses the light of the terrelle, under common pressures of the atmosphere, becomes in some measure incomprehensible. A second cause of the *difference*

of intensity of the two polar lights, is to be sought in the odic influence exercised by the sun and moon upon the earth. In the fourth Treatise (§ 95 *et seq.* and § 118 *et seq.*) I gave an account of some experiments which demonstrated that the two heavenly bodies strongly charge with Od all bodies exposed to their rays. The surface of the earth, on which they constantly shine, receives accordingly an uninterrupted supply of Od, in the same way as of light and heat. Thus it is not merely the inherent Od, proper to the earth and its magnetism, that appears concentrated at its poles, but this is continually receiving accessions through the vast contributions poured out upon the earth by the sun and moon. In accordance with their own laws, when these reach the surface of the earth they not only flow to the regions which possess a weaker charge, but at once become polarized, that is to say, the current goes towards the terrestrial poles, and increases the intensity of the odic phenomena there. The want of uniformity in the condition of the earth's surface, according as it is or is not covered with clouds, since in the former case the odic radiations are absorbed by the atmosphere, while in the latter they reach the solid substance of the globe,—moreover, the differences of position of the sun and moon in relation to the earth, the co-operation or antagonism of these,—all these things necessarily cause irregularities in the appearance of the northern light, as they do in the weather generally; and this explains the differences between the intensity of the odic light of the *terrelle* and that of the terrestrial poles, and to a certain extent shows their necessity.

604. If it should be objected that there is no magnet passing through the earth as through my *terrelle*, I think I can give this a sufficient answer; for it does not set aside the demonstrated and established fact that the earth really possesses magnetic poles, whether these depend on the surface and its irradiation by the sun, as the modern physicists think there is reason to assume, or are derived from the internal conditions of the entire planet. In regard to the latter supposition, however, there is a point in its favor, which, so far as I know, has not yet been taken account of in physics: I shall take the liberty to explain it here. It is now pretty generally agreed that meteorites are of planetary origin, that they are minute stars, which have originated under the same laws, and follow their paths around the sun in the same way as the larger and smaller planets. And in reality the difference is not much greater between the vast Jupiter and the little Vesta or Astræa, which are scarcely larger than the Island of Ceylon, than between an asteroid such as these and the enormous meteorites lying in Senegal, stated to form small mountains of iron. And from these, again, through those of Bahia, Durango,

and Zacatecas, which are masses of iron weighing many tons, to our ordinary meteorites of a few pounds, there is every step of gradation. Thus, from Jupiter down to the smallest meteorite, we have an uninterrupted series, so that apparently size alone affords distinction between a planet and a meteoric stone. If this be admitted, and, indeed, it cannot now be avoided, the structure of the meteorite places in our hands a key of extreme value, opening the way to the examination and study of the probable internal condition of the earth. The law which gave the rule for the composition of the meteorite, gave it. consequently, for the construction of our globe. Now, meteorites are composed chiefly either of metallic masses, mostly iron with a portion of nickel, or of stony masses, almost always containing a great intermixture of this metallic nickeliferous iron. This is universally known; but it is not known—and this is of essential importance here—that in the majority of meteoric stones the abundant proportion of iron does not occur in irregular, accidental, and isolated fragments, but the form of a *connected cellular network*, traversing the whole mass. This may be seen with the naked eye in the meteorites of Krasnojarsk, of Atacama, in the original mass of iron at Bittburg, and in the meteorites from unknown localities, resembling these, in the collection at Gotha, &c. And in such also as are more minutely intermixed, like those from Smolensk, Seres, Blansko, Tabor, Barbotan, &c., and have the same structure, the stony portion may be extracted, leaving a connected cellular network of iron. The specific gravity of these stones is from three to four and five. That of the earth, as is well known, is about 4·7, and all this renders it probable that it is constructed internally like a meteorite, of a congeries of iron cells, that its entire stony mass is interpenetrated by cellular metallic iron, exactly as in the majority of meteoric stones. *And in this iron would the magnetism of the earth dwell.* The irregularity of its distribution, as seen in every meteoric stone, and therefore to be assumed in the earth, renders the four-fold polarity of the terrestrial globe readily comprehensible.

605. This view of the constitution of our planet, of which geologists have not yet made any use, but which, as is seen, rests on a foundation of facts in natural history, is not contradictory to the now generally adopted hypothesis, that strata of molten matter in igneous fusion may still exist beneath the lowest of our geological formations. That such strata do exist is as certain as that meteorites arrive at the surface of our earth, still hot and coated with recently-molten clay. The remarkable meteorite of Clairborn, Alabama, was enveloped by a crust of slag one-fifth to one-third of an inch thick, when I received it. I received a mass of meteoric iron from Caryfort, Decalb County,

U. S., with a crust one-sixth of an inch thick. I possess aerolites from Nanjemoy, Maryland, covered in places with a porous slag one-seventh of an inch thick. But there is a wide interval between such a coating, and a melting and a state of igneous fusion *throughout the entire mass.* The earth has really an incandescent or still fluid coating some inches thick, analogous to the slag crust of the meteorites; the abundant proofs are too strong and too consistent to admit of a doubt of it; but it by no means follows from this, that it must be in a state of incandescent fusion throughout its whole mass, as is commonly much too hastily assumed. It is beyond all comparison more probable that its internal structure is like that of a meteorite, and, indeed, of a meteoric stone containing iron, perhaps of several united together, since we see new ones becoming united to it daily before our eyes.

606. Certain physicists, in particular Mr. Faraday, have asserted that it is impossible for the earth to be magnetic throughout its mass, if it be in igneous fusion in its interior, as we know from experiment that great heat is incompatible with the presence of magnetism in bodies. This objection is only important so long as we regard the *whole* contents of the planet as a lava. There is not only no strict reason for so doing, but a number of circumstances are directly opposed to it, none of which I shall bring forward here, except those I have just developed from the analogy with meteors. All these are melted merely on the surface, and in their interior consist of crystalline structures produced by a force which can be proved to have operated wholly and exclusively in the cold. Meteorites have been placed in circumstances in which excessive heat has acted upon them externally, melted their surface, and produced lava upon it, but this only for a short period, sufficient to melt down but a very limited portion of the surface. The earth has also once passed through such a period, in the same way, only a crust of the substance composing it could be melted, now represented by that incandescent fluid stratum beneath our cooled surface, by which geologists satisfactorily explain our volcanoes, our basalts, trachytes, porphyries, and the heat increasing with the depth in every shaft and boring; the hypothetical basis on which all this rests having received general recognition. But such a mere crust of glowing matter, even if miles thick, cannot annihilate or even essentially affect the operations of the magnetism of the enormous cold, iron-traversed, globular mass more than 8000 miles thick.

These considerations, therefore, go to prove that the terrestrial globe is traversed by a magnet just in the way I have, in imitation, placed one in the *terrelle*, and thereby sought to bring the latter into condition, which should to a certain extent resemble those of the earth.

607. But *this iron*, assumed, as it must be, to be interwoven through the globe, *is also crystallized throughout.* When meteoric stones are ground and polished, and then very slowly corroded by diluted nitric acid, crystalline characters, which become distinctly visible under the microscope, make their appearance in all the portions of iron, however small they may be. There have been demonstrated to be markings identical with those called Widmanstetten's figures, on masses of meteoric iron, and they are nothing else than crystalline structures of the metallic constituents. I have investigated a great many in my own collection, and have found they contained metallic iron, everywhere crystallized, exactly in like manner, and according to the same laws and figures, as in the large masses of iron. I have dug out of the meteoric stones of Blansko little particles of iron, which, when polished and corroded, small as they were, exhibited not only planes of cleavage, but also pyrites enclosed in the iron, exactly like the large masses of meteoric iron. The masses of meteoric metal, therefore, have magnetic and odic polarity from two causes: the one that they partially consist of a *mass of iron which is continuous throughout*, although cellular; the other, that *this metallic mass is crystallized*, perhaps composed of one single vast crystal, irregularly formed, certainly, on the surface, but cohering intimately according to the laws of crystallization. But we know, from § 55 of my second treatise, that all crystals unceasingly emit concentrated odic light from their poles. The contained iron, therefore, and crystallization, act in conjunction to produce magnetic odic poles upon the terrestrial globe, and they afford the grounds which render it probable, in my eyes, that the magnetism and Od of the earth are not simply external and due to the sun's rays, but are in great part, if not chiefly, to be ascribed to internal causes; in following out which, the otherwise singular fact that the astronomical and magnetic poles of the earth do not coincide,—that we have, not two, but four, magnetic terrestrial poles, &c.,—loses its strangeness, and becomes readily explicable. Thus the polar light of the terrestrial globe, like the odic luminous phenomena of my *terrelle*, may, on magnetic and odic grounds, be confidently attributed for the most part to internal action. We may regard both as diametrically traversed by actively magnetic and odic axes. The analogy between the entire planet and the miniature artificial imitation of it, is, therefore, quite complete on this side of the question.

608. An old observation made in Sweden by Wilke may also deserve to be recalled to recollection,—that *the appearance and the*

movements of the northern lights are always PRECEDED *by disturbances of the magnetic needle.** This, as is seen, agrees most exactly with the odic phenomena: the latter always occur later and more tardily than the magnetic and electrical movements complicated with them, an observable pause always intervening before the commencement of the odic effects. Thus the same things which I have made out as above described, in the investigations in my dark chamber, were observed by others many years ago in the open sky.

609. Finally, I have to refer to Wargentin's observation that *the northern lights weaken the magnetic needle.* This is now explained without difficulty. The northern light is an odic magnetic emanation, material or immaterial, whichever we please to assume. When it issues from the north pole it is of positive magnetic nature. But the northward pole of the needle is negative. When +M passes over the needle from north to south, as the northern light does, it amounts to the same thing as if the southward pole of a very weak magnetic bar were passing uninterruptedly over the needle from north to south, for a length of time equal to the duration of the northern light. The effect of this must be like that of a weak ordinary rubbing; and every one knows that a needle loses strength, or, as Wargentin expresses it, becomes dulled, when so treated, if rubbed in a direction contrary to its polarity. The northern light makes, over the needle, a weak but not the less real reversed pass, which, from its nature, tends to carry the south polarity of the north point of the needle to its south end,—that is, to reverse it; and, since it does not possess intensity sufficient for this, it merely weakens the needle, thus dulls it, and so, as Wargentin adds, renders it less sensitive to subsequent northern lights.

610. Thus everything, without exception, that has been made out, in the endeavor to extend our knowledge of Od, has contributed to increase the harmony with which all the facts agree to mark *the northern light as an enormous manifestation of magnetic odic flame, odic vapor, and odic light;* a miniature representation of which was afforded by the *terrelle.*

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* Gehler's physisch-Wörterbuch (Physiological Dictionary), i. 161.

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